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REMOTE STORAGE



Administration Building,
Washington Park, Chicago.

Unfinished Surface.
Special Mixture.

Concrete Surfaces

The proper finishing of concrete surfaces is a problem that is receiving more and more attention each year and the satisfactory results obtained where suitable methods of surface treatment were employed have served to eliminate an unjust objection to the use of concrete for exposed surfaces, where a pleasing and artistic effect, both as to texture, and color, is desired.

Next to the general design of a structure, the character of the surface is probably its most noticeable feature and has the most effect on its appearance. No matter how suitable a material may be in other respects, if it does not present a pleasing appearance in its unfinished condition, or if it cannot be finished in an

attractive manner its field of usefulness as a building material is limited. Early experience with concrete seemed to reveal a weakness in this respect. The trouble, however, was not with the material, for there is probably none other so well adapted to all classes of construction, but rather to the fact that proper attention was not given to the placing and finishing of the work.

The ordinary untreated concrete surface it must be admitted is anything but pleasing in appearance, being a comparatively lifeless surface of somber grayish color. It makes but little difference what cement, sand or aggregate is used or how they are mixed, the untreated form surface is the same, and it



Reinforced Concrete Viaduct,
B. & O. Ry., Philadelphia, Pa.

is this monotonous similarity in appearance of all untreated concrete surfaces that architects object to so strongly.

There may be the greatest difference in color, shape and texture of the aggregates used in two separate surfaces, yet unless they are so treated as to bring out and expose the aggregate they will look exactly alike. It is quite difficult to distinguish an unfinished concrete surface in which ordinary bank gravel is the aggregate, from one in which crushed red granite, for example, is used, but the same surfaces if subjected to any one or a number of different methods of surface treatment will present a marked and pleasing contrast in appearance.

By varying the kind, size and proportion of the aggregates, surface finishes of practically any desired color and texture may be obtained, the possibilities being limited only by the number of different aggregates available and their possible combinations. The color is obtained from the exposed aggregate, not by adding coloring matter to the mixture. A great variety of finishes may be produced by the use of the common aggregates to be found or easily obtained in nearly all localities, such as limestone, granite or other stone screenings, marble chips and different colored gravels and sands.

To expose the aggregate the film of mortar that flushes to the surface next the forms must be removed. This may be accomplished either by brushing or washing the surface before it has hardened, or by tooling or sand blasting it after it has thoroughly hardened. The method of procedure is as follows:

Having decided upon the general color scheme, the texture of the surface and the method of surface treatment to be used, the first step is the making and finishing of small sample surfaces. A limited amount of experimenting with materials available will always prove profitable. The color and texture of the finished surface depends upon the color and size of the aggregates used and the successful production of the desired

surface is dependent upon the proper selecting, grading, proportioning, mixing and placing of the materials as well as the finishing of the surface. Upon determining, by experiment, the size and proportion of aggregates required to produce the desired effect, and the proper consistency of the mix, adhere strictly to them. Take the trouble to measure the materials for each batch of facing material and to gauge them with a measured amount of water. The results obtained will more than justify the small additional time and expense this will entail over the all too prevalent method of measuring materials by wheelbarrow loads and adding water with a hose. In fact, uniform results cannot be obtained unless the work is done as pointed out.

A pleasing concrete surface cannot be obtained by nicety of form construction alone. The slightest imperfections and irregularities in the form surfaces are transferred to the concrete, producing unsightly surfaces when left unfinished. Where the surface is to be finished after the removal of the forms, all that is required of the forms is that the face lagging be kept true to surface and the joints be tight. For surfaces that are to be finished by brushing but which are too large to concrete in one day, the forms should be so constructed as to permit of the removal of sections of the face form without disturbing the uprights. This can be accomplished by setting the studs or uprights back a few inches from the face lagging and connecting both by means of cleats and wedges. With this construction only enough lumber for one day's concreting is required, the form being shifted up the next day to receive the next course. The forms for the back of the wall may be constructed in the same manner as described for the face forms, but are usually constructed in the ordinary way and left in place until the work is completed. The face forms should also be well oiled to prevent the concrete from sticking to them.

For large areas the introduction of buttresses and

panels or the breaking up of the surface by horizontal joints or courses will add greatly to the appearance of the work, the joints simply being indentations in the surface, produced by small triangular, square or rectangular strips of board nailed to the forms. It is extremely hard to join two different days' work so that the joint is not perceptible and unsightly, even when the surface is finished, and the breaking up of the surface is indicated will greatly assist in the concreting if care is taken to end and start a day's work at a course or joint. The results obtained by the use of these strips are clearly shown by the cuts herewith.

Where special or expensive materials must be used to obtain the desired surface finish they are used only in the mixture applied as a facing to the exposed surface. The facing mixture as a rule is from 1 to 1½ inches thick, the remaining thickness of the work being composed of ordinary concrete, but the facing and backing must be deposited at the same time so as to make one solid mass in order to insure a perfect bond.

Concrete blocks, architectural stone and similar work cast in molds where a facing material is used on but one surface should be cast face down. For vertical walls the facing material may be applied to the forms just ahead of the backing which is placed against and rammed into it, or the backing may be placed first and pushed back from the forms with a spade, and the facing material deposited between the backing and the form. Both these methods have been successfully used.

A third and possibly the best method of placing the facing material on vertical surfaces is by the use of what might be called a metal facing form or mold,

consisting of short lengths of iron plates 8 or 10 inches wide and about 6 feet long with three angle irons riveted to each plate. The size of the angle required will depend upon the thickness of the facing material desired. An angle should be placed at the center and one about 6 inches from each end of the plate, one edge of which should be provided with handles and slightly flared to assist in depositing the material.

The metal facing form is placed against the wall form with the handles up and the angles tight against the form. The space between it and the back of the wall is filled with ordinary concrete backing and the 1 inch or 1½ inch space between the metal form and the face form is filled with facing material. The metal form is then drawn almost out and after thoroughly tamping the backing against the facing the process is repeated.

For the facing material a fairly rich Portland cement mortar or a rich concrete should be used. Rich mortars have a tendency to check and craze, and for this reason mortar containing more than one part cement to two parts fine aggregate should not be used. Mixtures of one part cement and 2½ or 3 parts of suitable sand or stone screenings have been found to give excellent results. Where both fine and coarse aggregates are used in the mixture for the facing material a 1:1½:3, 1:2:3 or even a 1:2:4 concrete with cement, sand or stone screenings and crushed stone or screened gravel will give good results. The minimum thickness of the facing material should in no case be less than one inch, and where concrete is used not less than twice the maximum dimension of the large aggregate used.

THE "BOSS" CONCRETE MIXERS

The American Cement Machine Company, 9635 Johnson Street, Keokuk, Iowa, has issued an attractive catalogue entitled "Specifications," which relate to the leading lines of concrete mixers turned out by this concern. Special reference is made to the "Boss," which embodies a high speed "Re" mixing action which it is claimed mixes and discharges the concrete faster than is usually the case and with fewer drum revolutions. It is claimed that a batch may be mixed in 15 seconds and discharged in from 10 to 15 seconds, owing to the fact that the discharge spoon extends nearly two-thirds the way through the drum and every one of the deep scoops or buckets discharges into it. The claim is also made that the machine will mix concrete, grout or semi-dry mortar and plaster. It is practically self-cleaning, and its constructive features are such as are likely to interest contracting-builders generally. It is made in sizes and styles to meet varying requirements and in the catalog in question full information concerning the salient features is set forth. Attention is also called to the "Boss" hoisting attachment, and to watering devices for concrete mixers. A page of the catalog is given up to detailed tables of capacity and weights of "Boss" mixers; also diagrams showing the general dimensions.



Concrete Foundation,
Indiana Tuberculosis Hospital,
Rockville, Ind.

Brushed
Concrete Surface.
No Special Facing.

CEMENT AND ENGINEERING NEWS

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Advertising Rates Sent on Application

JOHN F. WALDRON

Advertising Manager

CHICAGO, JANUARY, 1917

PORTLAND CEMENT IN 1916

The year 1916 undoubtedly holds the record for shipments of Portland cement; the next highest record was in 1913, when 88,689,377 barrels were shipped. In production 1913 apparently is still the record year, with an output of 92,097,131 barrels, although there is a possibility that the final returns may give 1916 the lead.

Higher prices for cement prevailed throughout the United States except at a few points where top prices were realized in 1915. Trade conditions were generally reported as decidedly better than in 1915, and in many places the only limitation in output seemed to be shortage of labor and of freight cars.

Six new plants reported production of Portland cement in 1916, one each in California, Minnesota, New York, Oklahoma, Oregon, and Texas.

The following statistics, compiled by Ernest F. Burchard, of the United States Geological Survey, Department of the Interior, are based mainly on estimates reported by manufacturers. Returns were fairly complete from all states except California, therefore the figures for the Pacific coast district are least reliable. The figures for stocks are not considered accurate, as they could not well be checked over by manufacturers until after the end of the year.

Portland cement produced in the United States in 1916 (Estimate), and 1915, by Districts (in Barrels)

	Actual, 1915	Estimate, 1916	Change, Per Ct.
Lehigh district (eastern Pennsylvania and western New Jersey)—			
Shipments	24,598,950	25,425,000	+ 3.4
Production	24,876,442	24,086,000	— 3.2
Stock	3,400,936	2,150,000	—36.8
New York State—			
Shipments	5,275,101	5,849,000	+10.9
Production	5,043,889	5,699,000	+13.0
Stock	723,019	761,000	+ 5.3
Ohio and western Pennsylvania—			
Shipments	7,528,383	8,179,000	+ 8.6
Production	7,300,498	8,013,000	+ 9.8
Stock	873,112	635,000	—27.3
Michigan and northeastern Indiana—			
Shipments	5,480,428	5,746,000	+ 4.8
Production	5,485,951	5,508,000	+ 0.4
Stock	682,062	437,000	—34.6

Southern Indiana and Kentucky—			
Shipments	2,762,941	3,312,000	+19.9
Production	2,828,561	3,264,000	+15.4
Stock	501,432	454,000	— 9.5
Illinois and northwestern Indiana—			
Shipments	10,879,655	10,701,000	— 1.6
Production	10,242,869	10,374,000	+ 1.3
Stock	1,480,024	1,172,000	—20.8
Maryland, Virginia and West Virginia—			
Shipments	3,166,721	3,334,000	+ 5.3
Production	3,193,805	3,201,000	+ 0.2
Stock	359,913	235,000	—34.7
Tennessee, Alabama and Georgia—			
Shipments	3,099,770	3,594,000	+15.9
Production	3,010,037	3,517,000	+16.8
Stock	281,919	193,000	—31.3
Iowa, Missouri and Minnesota*—			
Shipments	9,218,820	11,281,000	+22.4
Production	9,186,401	10,704,000	+16.5
Stock	1,440,304	839,000	—41.7
Kansas, Oklahoma and central Texas—			
Shipments	6,517,258	7,681,000	+17.9
Production	6,274,863	7,535,000	+20.1
Stock	750,874	462,000	—38.5
Rocky Mountain States (Colorado, Utah, Montana and western Texas)—			
Shipments	2,453,095	3,099,000	+26.3
Production	2,472,069	3,084,000	+24.8
Stock	229,324	200,000	—12.8
Pacific Coast States (California, Oregon,* and Washington)—			
Shipments	5,910,559	6,307,000	+ 6.7
Production	5,999,522	6,209,000	+ 3.5
Stock	1,058,247	838,000	—20.8
Total—			
Shipments	86,891,681	94,508,000	+ 8.8
Production	85,914,907	91,194,000	+ 6.1
Stock	11,781,166	8,376,000	—28.9

*No production in Minnesota and Oregon in 1915.

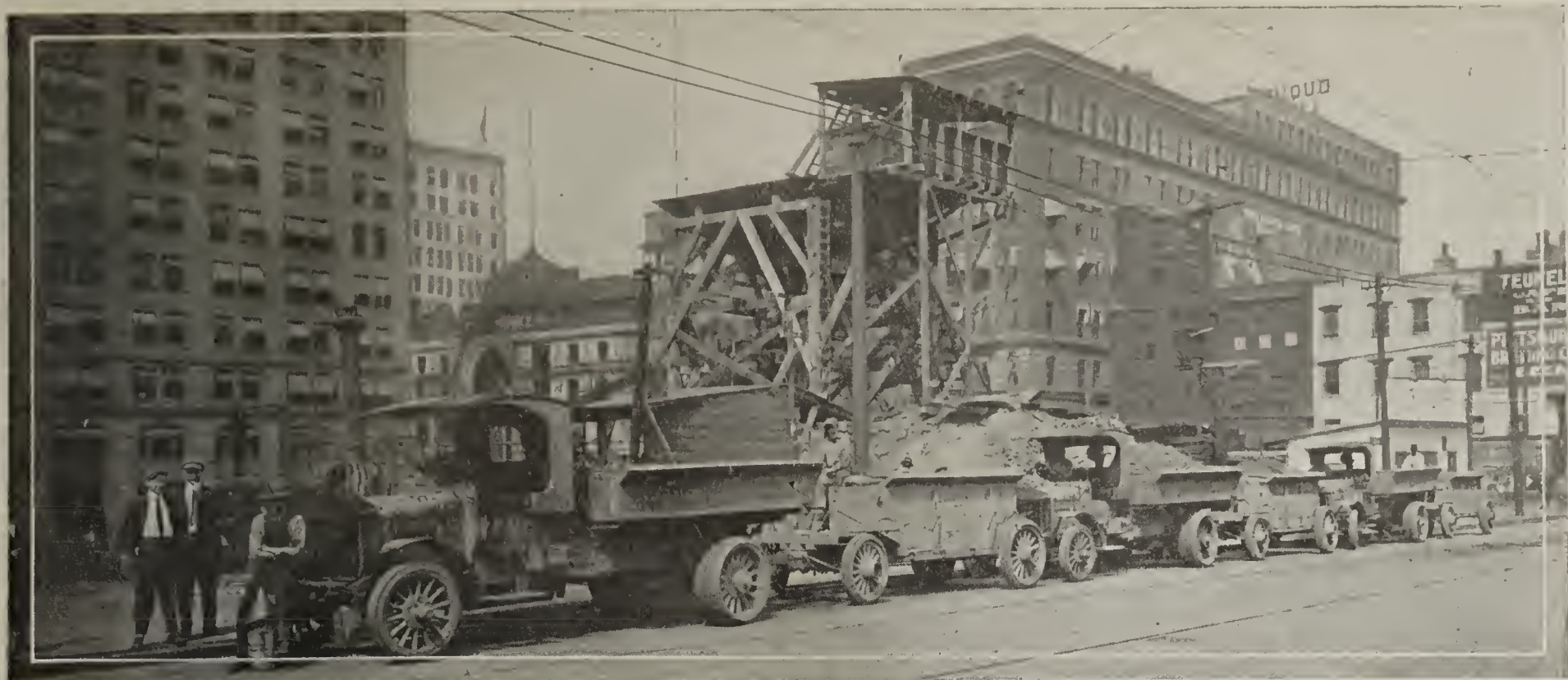
1917 CHICAGO CEMENT SHOW

The Cement Show which has been held in Chicago nine successive years will occupy the Coliseum and annex for its tenth exhibition February 7-15, 1917. The number and character of exhibits for which space has already been reserved insure its success.

The Tenth Cement Show will be housed under one roof, making necessary the use of the balcony as well as the main floor and annex of the Coliseum. Applications have been made by prospective exhibitors for 60 balcony spaces in addition to all the main floor and annex.

The exhibits assigned to the balcony would make a fair-sized Cement Show in themselves. Because of the impracticability of placing heavy exhibits in the balcony, it was necessary to assign the lighter exhibits there. They will make an interesting and attractive display.

The exhibits as a whole are representative of the cement industry and allied interests to even a greater extent than those in previous shows. Road building machinery and equipment particularly will form interesting and instructive features of the show. These include road crushing machinery, sand and gravel screens and washers, storage bins, car unloading chutes, motor trucks and trailers, dump wagons, excavators, scarifiers, graders and road rollers, which, in addition to equipment for handling and placing concrete, will give the road engineer and builder an excellent opportunity to learn methods of use and comparative values of equipment.



Maximum Street Space Occupied by Stuart's Rolling Stock, as Represented by His Three Pierce-Arrow 5-toners with Their 5-ton Trailers, Drawn Up Alongside the New Hotel Site.

Highly Efficient Truck and Trailer Operation Rises to Emergency of Rush Work

Excavating Contractor Hauls 75,000 Yards of Earth in 60 Days for Pittsburgh's William Penn Hotel

Rush work in excavating for the new William Penn hotel in Pittsburgh recently occasioned the employment of a truck fleet in an unusually efficient manner. Contracts were awarded principally on a basis of speed and James L. Stuart got the excavating contract because he agreed to finish the job in 75 days and actually did it in 60, while his nearest competitor required 90 days. Naturally trucks had to be used to make any such a record as this; but even with an excellent equipment of trucks, it was necessary for Stuart to employ numerous other time-saving devices.

The work of the trucks was to haul the silt scooped from the earth by steam shovels, from the edge of the excavation to the river, where it was dumped onto barges. Three trucks with trailers did the work. With horses, to transport the same amount of material a day would have meant 120 horses and sixty wagons. It would have been impossible for this number of wagons to work on this job, however, owing to traffic congestion.

To haul the 75,000 cubic yards of material in 60 days required that the trucks work 20 hours a day, averaging eighty trips and 92 miles each.

At the cut, the steam-shovel loaded the dirt into mine cars, which, made up into trains were hauled to the surface by a small industrial steam locomotive. Here the cars were dumped into wooden hoppers raised above the street level, from which it was chuted into the vehicles. The haul was 1.2 miles in length, mostly down-grade to the river. At the river was a trestle. The trucks were equipped with hydraulic dumping gears, which made the dumping a matter of minutes. The trailers were of the bottom-dumping type, so that their entire loads were ejected in about the same time. At the loading hoppers the trucks were loaded in 30 seconds and at the unloading trestle less than 8 seconds were required to unload.

So as to economize time at the unloading point still further, the dumping section of the trestle was made in the form of a turn-table, so that the trucks with their trailers ran onto it head on, dumped their loads, and then, when the turn-table was swung half-way around, were able to run off without backing or turning. The loads as they sifted through the trestle were caught in wooden boxes which were swung by a crane over the barges and piled. The entire unloading time was less than 1 minute from arrival at the trestle to departure.

The return was up-hill, but was always made empty, so that the hills did not decrease the speed materially.

The equipment comprised three Pierce-Arrow 5-ton trucks and three specially-built bottom-dump 5-ton trailers, mounted on rubber tires and having their own brakes. The trailers held 3 cubic yards each and the trucks, 5.

The trailers were only used during the day shift. This was because they slowed down the trucks. In the daytime the street congestion was such that the trucks could only average 5 miles an hour, including stops. Such a speed by the trucks alone would have meant less than their full capabilities, so the trailers were attached to make up for the loss in time by increasing the yardage hauled per trip. At night, when the streets were clear the trucks operated alone, averaging 13 miles per hour, including stops, thus equalling the combined yardage of trucks and trailers under day conditions.

The average round trip consumed 15 minutes, although 7 was the record.

Much of the success of the venture is attributable to the attendance of a night inspector, who, during the 4 hours' rest between the night and morning shifts, carefully went over each of the vehicles and saw that everything was in good repair and adjustment. There were no delays due to mechanical trouble.

DENSITY IN CONCRETE

The importance of density in concrete appears not to be sufficiently realized by many who use that material, although all the text books devote considerable space to the subject of so proportioning the various aggregates as to secure maximum density. Density increases strength, but perhaps even more important is the fact that it decreases porosity. In some structures impermeability in concrete is desirable as a part of the service performed by the structure, illustrations being reservoir walls, sewers, cellar walls and floors, etc. Impermeability also serves to increase the durability of the concrete in many cases, in that it prevents the entrance of moisture which may afterward freeze and scale off the surface and possibly even weaken the interior structure of the concrete. In case of concrete pavements for either roadway or sidewalk, it is desirable that the concrete be waterproof to prevent expansion caused by absorbed moisture and also to assist in preserving as dry as possible the soil which acts as a sub-base.

The securing of density requires care in selecting and proportioning the ingredients so as to secure the complete filling of the voids in each class of aggregate by particles of a smaller size. If this is properly done, aggregates can be used of sizes up to almost any limit, providing the greatest dimensions are kept reasonably proportioned to the dimensions of the concrete structure; the large boulders used in concrete dams being an illustration. It is apparent that no matter how much care be taken in determining the right proportions of the several sizes of ingredients, unless these are thoroughly mixed so as to secure perfect uniformity and homogeneity, certain parts of the resulting mixture will contain more and other parts contain less than is necessary of some of the finer aggregates. Thorough mixing is therefore necessary; and not only this, but the mixing once having been effected, the concrete should be applied before there is any separating out of the coarse aggregate by gravity in the semi-fluid concrete.

In securing dense mixture, coarse sand is supplied to fill the interstices of particles of the next larger size, fine sand for the coarse sand interstices, and cement to fill the pores of the finer sand. It is apparently desirable, however, to go still further for a waterproof concrete and supply a material which will fill the pores of the cement. Very fine clay thoroughly mixed with the cement while dry has been used for this purpose with advantage; but one great difficulty in using this material is that of reducing it to its powdered condition and thoroughly mixing it with the cement, as it tends to form into balls or lumps which in actual work can with difficulty be entirely reduced to powder.

Recently attention has been given to the use of hydrated lime for this purpose and apparently with most promising results. The U. S. Bureau of Standards reported that by the use of this material it secured a mortar which was "almost impermeable at the two-weeks test." Hydrated lime has been found to have such fineness that 98 per cent passed a 200 mesh sieve and 99½ per cent passed a 100 mesh. Adding hydrated lime to the extent of 5 to 15 per cent of the amount of cement, depending upon the proportioning of the concrete ingredients, seems to give the most desirable results. When used in the concrete form which the reservoir at Waltham, Mass., was constructed, 5 per cent of hydrated lime being used in a 1-2-4 mixture, the result was a wall which, under a 40 foot head, showed no seepage except at occasional joints between different day's work. The material has been used in a number of other structures, including the Twin Peaks tunnel in San Francisco, now nearing completion, the Sweetwater Dam in California and several

other dams on the Pacific coast, the Stony Brook sewer of Boston, Mass., several concrete reservoirs and towers in Massachusetts and other states, the St. Louis filtration plant, the Milwaukee sewer, etc.

Other advantages claimed for the addition of hydrated lime to the cement are that it increases the plasticity of the concrete, causing it to flow more freely into the forms and at the same time reducing the tendency towards separation of the coarse aggregate from the mortar, thus retaining the advantages of thorough mixing. Also that it is hygroscopic, causing the concrete to retain moisture for a longer period than would otherwise be the case and thus reducing cracks and surface checking which result from shrinkage during the preliminary setting period. Just what the additional cost of hydrated lime would be, or in fact of any material finer than portland cement, we cannot say. The expense will of course be additional, since the material is used to fill voids and its addition will not appreciably increase the volume of concrete. The cost can not be great, however, and it would seem to be very well worth while to secure imperviousness in a great many classes of concrete structures if it can be done at moderate cost.

CONCRETING IN COLD WEATHER

Concrete work can be carried on successfully in cold weather. All that is necessary is to heat the sand and pebbles or broken stone and mixing water so that the concrete mixture will have a certain minimum temperature, then to place the concrete quickly and maintain the heat until early hardening has been completed. This does not mean that there are no limitations to the practicability of doing concrete work in cold weather, but that if a few simple precautions and protective measures are used, winter concrete work will be as successful as that done in warm weather.

Many contractors have found their working season profitably lengthened by using these precautions and protective measures. This means that men and equipment can be kept profitably employed almost regardless of season. In this way the contractor can keep his efficient organization together. The resulting advantages are far greater than the seeming disadvantages—principal among which is that applying to necessary precautions slightly increases the cost of cold weather work. This, however, is usually offset by the builder's willingness to pay for the privilege of having the use of his building or structure earlier than would be possible if work were postponed until warm weather.

Things to Remember

During the first few days following the placing of concrete, alternate freezing and thawing at comparatively short intervals will damage it.

It is necessary to so mix, place and protect the concrete that early hardening will be complete before the work is exposed to freezing temperatures.

Remember that to do this:

1. Sand and pebbles or broken stone used must be free from frost or lumps of frozen material.
2. If these materials contain frost or frozen lumps, thaw them out before using.
3. As cement forms but a relatively small bulk of the materials in any hatch of concrete, it need not be heated.
4. Mixing water should always be heated.

Although adding common salt to mixing water will prevent freezing of concrete that has not hardened, there is a limit to the quantity of salt which may be added if the final strength of the concrete is not to be affected. Salt simply lowers the freezing point of the mixing water; it does not supply what is most needed—heat and warmth. It delays, instead of hastens, the hardening of the concrete.

The sand and pebbles or broken stone and mixing water must be heated so that the concrete when placed shall have a temperature of from 75 to 80 degrees.

Some sands are injured by too much heat. The same applies to certain varieties of pebbles and broken stone. A temperature not exceeding 150 degrees Fahrenheit will generally prove most satisfactory.

Remember to place concrete immediately after mixing so that none of the heat will be lost before placing in the forms.

Warm metal forms and reinforcing before placing concrete. Be careful to remove ice and snow and frozen concrete remaining on the forms from preceding work. Forms can be warmed by turning a jet of steam against them or by wetting with hot water.

Even though materials have been heated and the concrete placed immediately after mixing, it will lose much of its heat if not protected from low temperatures. Therefore, protect the concrete immediately after placing. Canvas covering, sheathing, housing-in the work, or hay or straw, properly applied will furnish the required protection for some work. In addition to these means, small oil or coke burning stove or salamanders may be used in enclosed structures.

Temperatures which may not be low enough to freeze the concrete may, nevertheless, delay its hardening for a considerable time. Do not expect concrete placed when the temperature is low and remains low for some time afterward, to be safe for use as soon as though placed during warmer weather.

If concreting is unavoidably delayed or interrupted the work should be covered until concreting is again begun.

Protect Work as Soon as Completed

Cover and protect any sections of the work as soon as completed. In severe cold weather, continue this protection for at least five days.

Forms must not be removed from the concrete work too early. This applies to any concrete work, regardless of season, but is particularly important with work done during cold weather.

Frozen concrete sometimes very closely resembles concrete that has thoroughly hardened. When frozen concrete is struck with a hammer, it will often ring like properly hardened concrete. Before removing forms, examine the work carefully to see whether it has hardened or is simply frozen. To determine this, remove one board from some section of a form, pour hot water on the concrete or turn the flame of a plumber's blow torch or a jet of steam under pressure against the concrete. If frozen, the heat will soften the concrete by thawing the water contained in it.

Although concrete which freezes before early hardening has been completed may not be permanently injured, if after thawing out it is not again exposed to freezing until hardened, protecting the concrete against possibility of freezing is best.

* * *

Concrete should not be too wet or too dry. If too wet it will shrink an excessive amount in setting and hardening; if too dry when placed it will not be dense, as the mortar will not run into the spaces. It is better to use too much than too little water, but mixtures that are too wet are not so strong as medium mixtures.

DANIEL McCool PASSES AWAY

Daniel McCool, who organized the Newaygo Portland Cement Company, Newaygo, Mich., in 1898, and with which he had been actively identified up to the time of his death, having been the president of the company many years, died last week at his residence in Grand Rapids.

BLASTS WITH ARCTIC EXPLOSIVES

The following two blasts were made with Arctic No. 5 in a large quarry in the eastern part of Pennsylvania.

The first blast was made during the early part of February this year, and consisted of twelve 5-inch well drill holes from 95 to 105 feet deep. They were spaced 17 feet apart and 26 feet back from the face of the quarry. Two-inch by 8-inch cartridges were used. All holes had about four or five feet of water in them. The cartridges were all slit.

All holes were loaded solid with an average of about 18 feet of tamping. The Arctic loaded well and packed nicely. In each hole there was placed three No. 8 Electric Blasting Caps which were connected in parallel and fired by a power circuit.

There was from 650 to 800 pounds of Arctic No. 5 loaded in each hole, or a total of 9,050 pounds in the twelve holes. It was estimated that about 45,000 tons of material were blasted down, or about five tons of material to one pound of explosive.

The second blast was made the first part of March this year, and consisted of fourteen 5-inch well drill holes ranging from 85 to 90 feet in depth. The spacing of the holes was the same as above noted. Two-inch by 8-inch cartridges were used and all were slit. All holes had about four or five feet of water in them except two into which the water was running.

In this blast the Arctic No. 5 was used instead of a straight 40% strength dynamite and did excellent work. On account of the lower density of the Arctic No. 5 there was from 50 to 100 pounds less used per hole than would have been used of the straight explosives. The Arctic loaded well and all holes were loaded solid with an average tamping of 16 feet.

There was from 575 to 650 pounds loaded in each hole, or a total of 8,375 pounds used in the blast. This blasted down about 44,000 tons of material, or at the rate of about $5\frac{1}{4}$ tons of material to one pound of explosive.

The stone in both blasts was broken up in good shape.

Why not try some one of the Arctic explosives in your quarry?—Du Pont Magazine.

NEW BOOKLET OF MEDUSA WATER-PROOFED CEMENT

Cement and Engineering News is in receipt of a copy of the new issue of the Medusa Waterproofed Gray Portland Cement booklet.

Medusa Waterproofed Portland Cement consists of Medusa Waterproofing ground with Gray Portland Cement in the process of manufacture, in correct proportions and in a scientific manner, eliminating the cost of labor for mixing as well as the danger of unsatisfactory results due to improper mixing.

Medusa Waterproofed Cement is being used in the same manner as any ordinary Portland cement, so that this product is considered a valuable building material and is finding great favor among architects, engineers, contractors and cement users in general.

The new booklet is very interesting and will be sent free on request. Write the Sandusky Cement Company, Dept. 7-8, Cleveland, O.

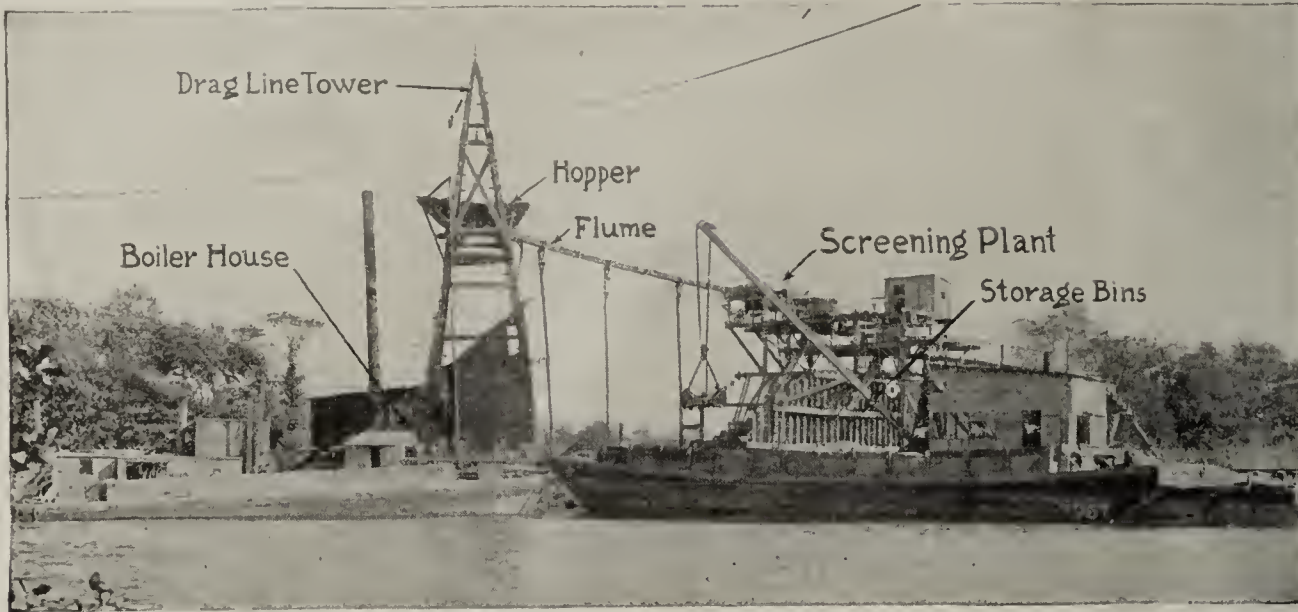
CEMENT TILE

Gabriel Longmuir, general contractor, Coal City, Ill., advises us he has just started manufacturing cement drain tile, having just purchased a machine from W. E. Dunn Manufacturing Company, 414 Twenty-fourth street, Holland, Mich., that makes both tile and concrete blocks.

DRAG LINE PLANT TRANSFORMED INTO A WASHERY

The transformation of an ordinary drag line plant into a washery was accomplished by the Link-Belt Company of Philadelphia for the West Jersey Sand & Gravel Corporation, Westville, N. J. The original plant consisted of a dragline tower, with a hopper which discharged direct to barges. To increase the capacity a flume, screens and separator were installed,

A bin of 1000 yards capacity has its limitations, as, if there is a certain slow-moving size of product, and the compartment for this product is full, the rest of the plant has to shut down until it is gotten rid of in some way. This is usually accomplished by means of an overflow chute or a belt conveyor to a separate storage pile; but in a plant of the type described here, a greater flexibility is obtained, and at a lower first cost of the installation.



Plant of the West Jersey Sand and Gravel Corporation.

the new plant washing and screening the sand. The hopper was left in its original position, a large drag line shovel or scoop was added, and the material flumed from the hopper to the screening plant by means of a jet of water.

The screening plant consists of three "Gilbert" type screens (so arranged that a duplicate set can be added later) located over three ground storage bins, which were made by building two partitions, thus getting three sizes of product on the ground. These screens are operated by Link-Belt drives from a small steam engine located on top of the bins. The sand and water are separated by a counterweighted settling box, the Link-Belt Sand-Separator, mounted on the small wooden tower shown to the right of the plant.

The material in the ground storage piles is picked up and reclaimed by a mast and gaff outfit, which either builds out the storage piles for further capacity, or loads direct to the scows.

This plant is operated by four men; one in the drag line tower, one fireman, one man in charge of the screening plant and engine, and one man on the mast and gaff outfit. The capacity is approximately 600 yards in ten hours, which can be doubled without much additional expense.

The above layout is a good example of what can be done with a small outlay of machinery, to give four or five sizes of cleaned products. The entire plant is run by a 100 H. P. boiler. The water is elevated and delivered to the screens and flumes by a 2-cylinder steam pump, and except for an occasional cleaning out of the fine mesh screen to remove pebbles that lodge in it, the equipment, from the hopper to the sand piles, requires no attention whatever.

The use of ground storage bins in connection with a mast and gaff outfit, or locomotive crane, is a very economical way to equip a plant of this kind, as the amount of storage available is practically unlimited. The crane can be used to pull out the material from the ground bins, and build storage piles of any capacity required, which can be readily reclaimed by the same machine when delivering either to cars or scows. In this way the objection to an enclosed bin is overcome.

AMERICAN CONCRETE PIPE ASSOCIATION

The annual convention of the American Concrete Pipe Association will be held in Chicago, February 12, 13 and 14, 1917, these dates falling during the second week of the Cement Show.



West Jersey Sand and Gravel Corporation.

The sand and water are separated by a counterweighted settling box.

CEMENT PRODUCTS FACTORY

The cement products plant, of Mr. Fred Goepper at Indianapolis, Ind., is one of the most efficient and economical plants of its kind in the country. He is operating it in connection with a successful business in other building materials, coal, etc.

The plant is about 40x60 feet in dimensions, and is housed in a low frame building, designed especially for it. The building represents the utmost economy in design and construction, but fulfills admirably the purpose for which it was intended, and with a fresh coat of paint it is a most sightly factory building.

The curing rooms, of which there are four, occupy about half the space of the plant. These rooms carry two tracks each, each track having a four-car capacity. The rooms are separated by partitions of tarred building paper on a substantial wood frame-work. Steam is admitted through pipes which enter the chambers through the ground and rise to distributing pipes near the top of the chamber. Each chamber is open at only one end—the inner end which opens onto the transfer track. Upward-swinging wooden doors close these openings when it is desired to turn on the steam. Windows in the opposite ends admit light to each chamber. Steam for curing is supplied by a thresher boiler, the stack of which extends up through the roof of the plant.

The work of the plant is done on two levels. The block machines, tile machine, and all molding apparatus, are on a plane with the tracks and kilns, while the material storage and mixers are on a concrete platform raised about 20 inches above the other working floor. This provides for a gravity delivery of the materials to the molds, eliminating a considerable amount of shoveling or other handling. The raised platform is indicated by shading in the drawing.

Mr. Goepper is doing a large block business, and for this purpose has two Dunn block machines. One of these is set permanently on the floor and is supplied with a Miller automatic tamper, which is used for standard sizes; the other is used incidentally for special forms as occasion requires.

This plan has also taken up the manufacture of cement drain tile and is supplying the demand in the locality. It is a branch of the business in which Mr. Goepper is much interested and he is doing much to develop it. One of his publicity methods is the distribution of a neat little vestpocket memorandum book giving some valuable pointers on tile, and arguments for the use of the cement product. This end of the plant is equipped with a Dunn drain tile machine of latest design, manufactured by the W. E. Dunn Manufacturing Company, 414 Twenty-fourth street, Holland, Mich. It is doing most satisfactory work and has a record as high as eight good tile per minute in this particular plant.

This shop has also a considerable demand for ornamental shapes, columns, vases, etc., and a good line of Dunn molds is to be found in pretty constant use. The workmen here have developed considerable skill in the use of these, as the stock in the yard, as well as many porches and other ornamental work throughout the city will testify.

A Lansing continuous mixer is used to feed the block machine with automatic tamper, while a Lansing batch mixer supplies the rest of the plant. A Noble pulverizing mill is run in connection with the mixers, through which is put any cement which may be lumpy from dampness or long storage.

One detail of no small interest about the plant is a belt conveyor running between the continuous mixer and the block machine. This is so located that the mixer discharges onto the belt conveyor, this latter

delivering the concrete into the hopper of the block machine. The belt is operated by power at a very slow speed, and is controlled by a friction clutch operated by a lever within easy reach of the machine operator. Electricity is used for motive power throughout the plant.

LEHIGH BUYS CHICAGO PORTLAND CEMENT COMPANY

The sale of the Chicago-Portland cement plant at Oglesby, Ill., reported in the Free Trader-Journal a few days ago, was confirmed in a statement which was given out by D. Ross Fraser yesterday. Mr. Fraser held the office of vice-president and superintendent under previous ownership and following his return from a business trip to Chicago made a formal announcement of the transfer. The purchaser is the Lehigh Portland Cement Company.

The Lehigh company's main offices are at Allentown, Pa., and the corporation operates a string of cement plants throughout the country.

Mr. Fraser is to remain at the Oglesby mill in the capacity of superintendent.—Ottawa (Ill.) Journal.

LINK-BELT LOCOMOTIVE CRANES

The Link-Belt Co., Chicago, Ill., has issued an elaborate 40-page catalog of Link-Belt locomotive cranes. The booklet is a high-class specimen of the printer's art and is amply illustrated. Locomotive cranes occupy today a highly important place in the art of handling materials. In the one machine is combined a portable hoisting engine, swinging derrick, grab bucket unloader and switch-engine.

Beginning some 15 years ago with the manufacture of very large radius heavy duty cranes for coal storage work, the Link-Belt company entered the standard gauge field, applying to their standard gauge crane the experience gained in the manufacture and operation of these large machines, supplemented by the most modern practice and improvements of the lighter designs. The Link-Belt standard crane is a machine of all-around utility; it is driven by steam or electricity, and equipped to operate grab bucket, hook block, electric lifting magnet, drag scraper bucket, steam shovel dipper and pile driver. Copies of the catalog may be obtained by writing to the concern.

A NEW BOOKLET ON REINFORCED CONCRETE BRIDGES

Reinforced Concrete Bridges of Luten Design—Daniel B. Luten, Indianapolis, paper, 9x12 inches, 48 pages, illustrated. A notable piece of printed matter containing illustrations of 50 bridges of Luten design, printed on heavy plate paper. Many illustrations are in color. The text is limited to a statement of Luten achievements and a striking illustration of the economy of concrete bridges.

GROUND MICA FOR FACING CONCRETE WORK

Pure white, sparkling ground mica specially prepared for facing concrete products is now being manufactured by the U. S. Mica Manufacturing Company, 14 East Jackson Blvd., Chicago. The trade name of their ground mica is "Micamina," which is five times lighter than crushed rock and goes ten times as far in use, and is not to be compared or confounded with any other facing material—it is in a class by itself. Costs less per square foot of surface covered and produces a finish of superior quality.

The Plant of the Dolomite Products Company

The Dolomite Products Company which until recently was known as the Holran Stone Company, is located a short distance from Maple Grove, Ohio, near the intersection of the main line of the Nickle Plate and the Mansfield & Toledo Division of the Pennsylvania Railroad about 35 miles from Toledo and 78 from Cleveland.

The splendid equipment and organization of this

shovel without interfering with cars being loaded at the second shovel.

Central Electrical Control of Quarry Cars

The shovels are served by heavily constructed 6-yard side dump cars, electrically equipped by the Woodford Engineering Company, Chicago. These cars weigh 10 tons when empty and about 20 when loaded to capacity. Each car is equipped with two 25 H. P., D. C. crane-



One End of Pit Showing Plant and Incline—Note Empty Car Descending to Quarry Floor.

plant has given it a prominent place among the leading stone handling plants in existence. The planning and organization of this plant may be placed to the credit of Mr. George W. Patnoe, general manager, whose extensive knowledge of quarry management has long been recognized. Mr. Patnoe took charge of the plant in 1912 and in the following year installed the Woodford system of central electrical control of quarry cars, one of its most interesting and unique features. The product of the plant is white dolomite limestone which is prepared for the market in nine sizes and combinations of sizes and sold for road making, concrete work for flux and slag, etc.

The quarry itself is oval in shape, about a third of a mile long and a quarter of a mile wide with a working face of 40 feet. The rock is being excavated by Bucyrus steam shovels. The blast holes are drilled with Cyclone gasoline drills, manufactured by the Sanderson Cyclone Drill Co., Orrville, O.

The Lay-Out of the Quarry

The track system is very simple. Instead of the ordinary system of sidings and spurs leading to a long straight incline, a third rail track of standard gauge descends from the crusher house down a short incline to the quarry floor. Here it follows the edge of the quarry, completing the circuit back to the plant. At one end there is an inner curve or cut-off for bringing empties to the shovel on the other side of the quarry without having to pass the first machine. At the other end there is a similar curve or cut-off to pass the loaded cars from the first

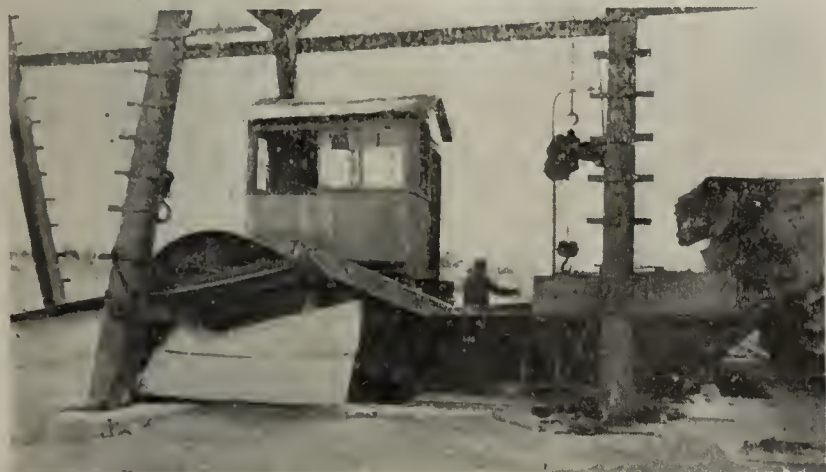
type Westinghouse motors directly geared to the axles. The movements of these cars are controlled by an operator in a tower near the crusher. As an empty starts down the incline from the plant a lever on its side strikes a device at the side of the track which sets the brakes and automatically governs the speed of the car. At the bottom, the lever is thrown back and from then on the car is entirely under control of the operator in the tower. The track is divided into a number of insulated circuits. Each circuit is repre-



Loaded Car Climbing the Incline. This Car Is Equipped with Two 25 H. P. Motors.

sented in the tower by a lever through which the operator can absolutely control the movements of the car.

As a result of this system, the labor in the quarry has been reduced to a minimum. The entire force required for drilling, blasting, for handling the two shovels and for transporting the stone to the plant consists of twenty men, including the men required for the operation of the tower and transportation line.



Car Dumping Into Hopper. The Man in Center Controls the Speed of the Belt Which Carries Rock from Hopper to Crusher.

At the present time with this force in the quarry, the plant had an output of about 3,000 tons a day.

The Plant

The plant itself contains many unique features. The loaded cars discharge into a cast steel hopper made to Mr. Patnoe's design by the Bucyrus Company. This hopper feeds on to an endless 5-foot steel link belt which carries the material to a 60"x48" Superior jaw crusher, both built by the Worthington Pump & Machinery Corporation of Cudahy, Wisconsin. The arrangement of this feeding is unique. The belt is driven by a friction clutch under control of the operator at

all stone under 2 or 3 inches, according to requirements at the time. Under this is another rotary screen which further separates the stone into sizes between $\frac{3}{4}$ inch and 3 inches, as required, the screen plates being changed as needed. The over-size is carried from the end of the screen back to the crusher floor by a steel spron conveyor to two No. 5 gyratory crushers. From here it is re-elevated and re-screened



Stripping Overburden and Loading 6-yard Cars.

in a 4-foot by 16-foot revolving screen. The "fines" ($\frac{3}{4}$ inch and under) are carried from the secondary screens on belt conveyors to the vibrating screens for final separation. These screens are considered to be a great asset, for stone passes over them quite slowly and is thoroughly shaken, emerging accurately sorted, and exceptionally clean. These screens are so designed that the shock, although sufficient for the purpose, is not a serious wear on the screens themselves. This is Mr. Patnoe's design. After final separation the product is fed into the proper bins and from there in the railway cars through spouts.

The output of the plant is at present about 3,000



A Blast in Front of the Steam Shovel—Cyclone Big Blast Hole Drill Shown to the Right in Background.

the mouth of the crusher, who feeds in the stone at the most advantageous speed. The result is that the capacity of the crusher is about doubled. The jaw crusher reduces the stone to 8 inches and drops it on to a bucket elevator which carries the product to the top of the house and delivers it to a No. 10 gyratory crusher. Here the reduction is to 6 inches maximum. Another elevator of the same type brings the material to a 5-foot by 24-foot revolving screen which passes

tons as stated, but this can be nearly doubled under pressure.

An operation carried on independently but always sufficiently far ahead as not to check the operation of the plant, is the stripping of the quarry. This is done with a Bucyrus revolving shovel equipped with a $\frac{7}{8}$ cubic yard dipper. This shovel is served by one train of 6 to 8, 6-yard dump cars hauled by a 20-ton Porter locomotive. The dump is $\frac{3}{4}$ of a mile away.

New Construction

The Dolomite Products Company have started extensive additions to the stone crushing plant and are erecting a large plant for the manufacture of dolomite limestone products. The additions to the stone crushing plant consist of one No. 10 gyratory crusher, one set 54" by 24" crusher rolls, two sets 36" by 16" crusher rolls, one 48" by 85', Patnoe elevator, two 5' by 20' revolving screens, two 48" by 16' revolving screens, two 48" by 18' Patnoe shaking screens with necessary conveyors, bins, etc., to properly handle the different sizes of the product. All of this equipment will be electrically driven, power to be furnished by the Ohio Light and Power Company who are now building a line with 1,500 H. P. capacity.

The new dolomite products plant is to be located 1,000 feet east of the present crushing plant. It will consist of steel and concrete buildings, storage bins and bunkers, covering an area of 416' by 86'. It will be equipped with dryers, rotary kilns, tube mills and grinders for the manufacture of several different dolomite products. The material is first prepared in the crusher plant and conveyed by gravity track to the dolomite plant in suitable railroad hopper cars. It will be dumped into track hoppers and elevated to the different departments and storage bins where it will then be conveyed to the machines by mechanically operated feeding devices which can be absolutely controlled as to quantity required.

Among the products of the new plant are magnefer, ground dolomite limestone for agricultural purposes, and burned lime. Magnefer is a substitute for magnesite, which is used in the lining of steel furnaces, and in the manufacture of high temperature resisting brick. Heretofore, magnesite has been imported, but due to the European war, it is now practically impossible to secure it in quantities sufficient for the needs of this country. This condition led the Dolomite Products Company to begin experimental tests to produce a substitute. They are of the opinion that they have succeeded in producing a substitute that is as good, if not superior to the imported article, and one that can be supplied to the user at a lower cost.

SKINNING CEMENT

An eastern daily recently published a short description of a building which collapsed, killing several workmen. In the story given it was stated that the building failed, due to the contractor "skinning cement" from the mortar.

One workman, the paper alleges, overheard a foreman say to the contractor: "For God's sake have a heart; put some cement in, for if you keep on skinning cement the building will fail."

Thus an attempt will no doubt be made to prove that this system of skinning cement has been the indirect cause of killing the unfortunate men who lost their lives when the building went down.

This story again brings forward the question, "Do contractors countenance the practice of skinning on cement?"

Unfortunately, we believe that this practice does obtain among some contractors. Just how prevalent it is cannot be stated. The custom dates back to the days when imported Portland cement sold from two and a half to five dollars a barrel and the contractor had to stand the loss of coooperation. Every pound of cement held out meant about a cent saved.

Then, too, contractors found that tables showing the amount of cement needed for certain proportions of mixed concrete do not hold out in actual practice, i. e.,

more cement is used than the theoretical figures call for, due to many reasons. Thus a contractor may order a thousand barrels of cement for a job, based upon the number of yards of concrete to be placed and the data given in the tables, yet when the job is finished, without the yardage on the concrete increasing, it is found that ten per cent more cement has been used. The increase at times may even exceed this.

If the contractor uses more cement than called for, it is a dead loss to him. Thus it may become necessary for him to husband his cement. Even if the contractor means to be honest in this direction, and he tells his cement man to watch carefully that the cement does not overrun, there is the chance that the man, to save money for the contractor, may skin on cement.

We know of no valid excuse for a contractor to offer for skinning cement. He contracts to make mortar or concrete of certain proportions and there can be no doubt that he should do all he agrees to do. Nevertheless, some contractors may think it to their interest to save a little extra on cement.

Thus it becomes necessary to make it the interest of the contractor to use all the cement that the engineer specifies. Fortunately, this incentive is not difficult to obtain, for in actual practice one prominent engineer has made the contractor as anxious to use the requisite amount of cement as the engineer is to have the proper amount in his concrete.

Thus on all the work under the Board of Water Supply of New York City, in charge of building the Catskill water system at a cost of about two hundred millions dollars, the proposals on concrete masonry are made on a yard of concrete, including all work of mixing and placing and of all materials, except cement. In addition to this price, the contractor is asked to submit a price per barrel for furnishing cement. Thus the price submitted per barrel includes the cost of the cement, the handling, insurance, hauling and all work incidental to purchasing, caring for the cement and using it.

The inspector on the job orders into each batch of concrete the number of bags or barrels desired, keeps a record of the cement used, and upon this record, which the contractor can easily have checked, the payment for cement is made.

In submitting bids, the engineer furnishes the proportional mixtures to be used, the estimated yardage of concrete and the estimated number of yards of cement desired. This gives a ready means of comparing bids. It is a fair basis of payment for both the contractor and the owner and saves the engineer much worry. It is the only method that this journal knows of that is fair for all concerned.

Some cities and other corporations have tried the method of purchasing the cement direct from the manufacturer, and furnishing it to the contractor for use, making the latter responsible for the cement. This method has given but indifferent results. The expense of handling and storing the cement is thrown upon the contractor without paying him for it. The cement is more than likely to be wasted. The men, knowing it is not the contractor's are indifferent as to the care they give it, and especially the empty cement bags, which represent money. There is a likelihood that some of the cement will be stolen. An incentive is not offered the contractor to care for the cement and use just what the specifications call for.

For these reasons we suggest, to both engineers and contractors, the New York method, to stop the practice of skinning on cement. It is also to the interest of cement manufacturing companies to advocate this method.—(The Contractor.)

Aggregates for Concrete Roads

REPORT OF COMMITTEE IV

CHAIRMAN D. A. ABRAMS

Professor in Charge, Structural Materials, Research Laboratory,
Lewis Institute, Chicago

A permanent road must be designed and built to withstand three different destructive agencies; namely, traffic, weather, and structural stresses. All of these agencies must be adequately provided for. It is generally impossible to distinguish between the effects of traffic and weather; the combined effect of these two agencies requires the most careful consideration on the part of the road builder. Assuming that weather resistance and structural stresses have been properly considered in the selection of the type of road to be built, and in the design and methods of construction to be used, the total effect of all other desirable qualities of a permanent road may be expressed as its wearing resistance.

The wearing resistance of a concrete road subjected to given conditions of traffic and weather will depend upon the following factors, named in the order in which they are encountered: The properties of the concrete materials; proportions and consistency of mix; thoroughness of mixing; method of placing; surface finish; conditions of seasoning; and age of the concrete.

The wearing surface of a concrete road is subjected to a most severe usage. The aggregates constitute 75 to 85 per cent of the material in a concrete road; hence the resistance to weather and traffic, and the final integrity of the structure, depend largely on the properties of the aggregates. Aggregates of the highest quality are essential. It is the function of this committee to report on the present state of our knowledge of concrete aggregates.

Properties of Concrete Aggregates

Important advances have been made in our knowledge of concrete aggregates and in the practices governing the selection and use of these materials since the adjournment of the First National Conference on Concrete Road Building. The carefully compiled specifications for aggregates formulated by that Conference and other bodies have been widely adopted and used with results which have been most beneficial. Greater care in the selecting and testing of aggregates has been a characteristic feature of recent practice in concrete road construction.

Experience has shown that other factors being equal, the life of a concrete road depends on the following qualities of the aggregates:

Durability of particles. (Toughness, strength, hardness, brittleness, density, resistance to weather, impact, abrasion, etc.)

Grading. (Size and shape of particles, amount of voids, etc.)

Cleanness. (Amount and character of impurities.)

Miscellaneous properties. (Chemical and mineralogical composition, structure, etc.)

These properties are named in the order of their importance for usual conditions.

All tests of concrete aggregates are made for the purpose of classifying the materials with reference to one or more of these qualities. Since wearing resistance is an important property of concrete for road building, we are principally interested in those qualities of aggregates which combine to produce a concrete of high resistance to wear.

Testing Concrete Aggregates

All tests of structural materials are made for the purpose of enabling the constructor to learn in advance of use whether the material is suitable for the purpose and to determine the relative utility of different available materials. The knowledge gained from the experimental studies of aggregates has not kept pace with the demands of construction. Most of our knowledge of the requirements for aggregates for use in concrete roads has been derived from observation of the behavior of the materials in service.

Due largely to the recognition of the necessity for careful scrutiny of the materials which are proposed for use in concrete roads, a widespread interest has arisen during the past few months in the study of aggregates and the tests which may be expected to indicate their suitability for this and other service. Aggregate testing as practiced at the present time is of recent origin, hence standard methods for conducting many of the tests have not been developed. Several of the leading engineering societies now have technical committees which are actively engaged in studying these problems. The testing of concrete aggregates is receiving more attention at the present time than ever before. It seems probable that these materials are now the subject of a larger number of experimental studies than any other group of engineering materials. Many of the materials testing laboratories are carrying out researches which will prove of the utmost value in arriving at a rational basis for proper specification requirements and tests.

It may be expected that long experience would indicate the relative merits of different materials and methods of constructing concrete roads. It is the function of careful tests and experimental researches to replace evolution and accomplish the desired results without the costly errors and delays which generally result, if the lessons of experience in service are to be our only guide. The tests of service will, of course, continue to be the court of last resort in determining the fitness of a material and the value of methods of construction, as well as to furnish a guide to proper laboratory tests.

Aggregate Tests

Tests of concrete aggregates may be made on the materials as delivered for use, or on mortars and concretes made from the materials.

Concrete is a manufactured product which results from mixing cement, water and suitable inert materials in the proper proportions and allowing the mass to season under favorable conditions. Recent advances in materials testing show the advantages of testing the finished product or the completed structure, rather than attempting to determine the quality of the product solely from information gained by a study of the component materials.

The wearing resistance of concrete is its most important characteristic for use in roads. Wear on a road surface is due to the combined action of stresses such as impact, abrasion, crushing, etc. Experience shows that concrete which will withstand street traffic will give a good account of itself in other respects. These considerations suggest a wear test of concrete as the most direct method for studying the relative

merits of different materials and methods. Experimental work of this kind is in progress in several laboratories.

The Talbot-Jones Rattler, which was originally designed for tests of paving brick, has been used for exposing the concrete surface to the tumbling action of a heavy charge of iron shot or blocks. This test is the most promising which has come to the attention of the committee. The Deval Abrasion Testing Machine has also been used for tests on small mortar specimens. These methods of testing have not been studied sufficiently to fully establish standard methods and to indicate the exact relation between the indications of the tests and the behavior of similar concrete in service. The data now available on wear tests of concrete do not justify the attempt to formulate specification requirements for aggregates on the basis of such tests.

In the absence of a satisfactory wear test of concrete, we must continue to depend upon the tests of component materials and concrete which have been shown to be significant in furnishing information on the quality of the aggregates.

On account of the great economies which result from utilizing materials that are readily available, and the absence of well-developed sources of supply in many localities, it is of prime importance that all aggregate materials for concrete roads be tested before use. All engineers of wide experience in concrete road building agree as to the importance of careful selection of aggregates.

In the following discussion only the more important tests are mentioned. A complete discussion is not attempted.

Under the heading "Durability," a number of the fundamental physical properties of aggregates have been grouped. It is difficult to discriminate between the effect of toughness, strength, hardness, brittleness, and resistance to weather, impact, abrasion, etc., in aggregates. It has not generally been considered necessary to make tests for the purpose of determining the effect of each of these properties. However, even though no tests are made, we must consciously or unconsciously weigh and pass judgment on all these factors before we can reach a conclusion as to the suitability of a given aggregate for use in concrete roads.

No satisfactory method of measuring the hardness of an aggregate is available. The exact influence of different degrees of hardness of the aggregates on the wearing resistance of concrete has not been determined. However, it would seem that the hardness of the aggregate should be well in excess of that of the cement itself after it has thoroughly set and seasoned, to the end that the impact and abrasion of traffic may be fully resisted. Uniformity in the qualities of an aggregate is of the utmost importance.

A direct determination of the compressive strength of an aggregate is seldom necessary, since the ultimate value of a material for concrete road building generally depends on other factors.

Certain tests for determining the toughness, abrasive resistance, etc., of crushed rocks have been used. These tests were introduced in this country by the United States Office of Public Roads. They have heretofore been carried out with particular reference to determining the suitability of rocks for use in macadam road construction. It is not clear now just what relation the evidence of these tests has to the suitability of a crushed rock for use as a concrete aggregate. Some of the tests which generally have been made cannot readily be applied to material of the size used for aggregates; none of them are applicable to natural sands and gravels. Modified forms of the

standard abrasion test with the Deval Abrasion Testing Machine have been used by some engineers as a basis for specification requirements for concrete aggregates. In these tests charges of cast iron or steel shot have been placed in the test chamber with the aggregate sample. The proportion of material reduced below a given sieve size is taken as a measure of the abrasive resistance of the aggregate. This form of tests deserves further study. There is a great need for a simple standard test which will serve to distinguish between aggregates which are too soft or too brittle for use in concrete roads, and those which may be expected to give satisfactory results.

Weather resistance is an important property of materials which are to be used in the wearing surface of concrete roads. A laboratory test which will furnish a reliable guide to the weather resistance of rocks under different climatic conditions has not been discovered, although many tests have been proposed and used. Alternate freezing and thawing, acids and disrupting agencies represent the most commonly used tests for this purpose.

The appearance of natural sands and gravels and a consideration of their origin and geological history will frequently furnish an indication of their probable resistance to weather. The examination of portions of the same stratum which has been exposed to the weather for several years will generally furnish a satisfactory criterion of the weather resistance of a crushed rock.

Grading.—The division of aggregates into fine and coarse is an arbitrary one. The distinction arose, no doubt, from the practice of securing the fine and coarse materials from different sources, and has been preserved largely for convenience in proportioning. It is almost universally customary to consider particles smaller than $\frac{1}{4}$ inch as fine aggregate and larger material as coarse aggregate.

Experience in the use and testing of concrete has shown that with a given proportion of cement, wide variation in the quality of the concrete result from differences in the grading of the aggregates.

A study of tests of sands and sand mortars indicates that the grading of the material, or the relative proportions of the particles of different sizes, is one of the most important factors which influence the mortar-making qualities of natural sands. All tests emphasize the advantage of using sands in which the coarse particles predominate and the fine are reduced to a minimum. A coarse, well-graded sand gives low voids, hence correspondingly high strength and improved wearing qualities. The so-called straight-line grading of sand conforms closely to that giving the highest strength in mortar tests. However, a certain degree of "workability" is essential; hence a larger proportion of fine sand than that indicated by the straight-line grading is generally desirable and is nearly always found in natural sands.

It seems probable that a more thorough study of the effect of grading of sands will demonstrate economies which may be effected by more accurate grading, and make it desirable to specify the required grading within narrower limits than is now customary. It is frequently found that a high-grade, fine aggregate can be produced by combining in the proper proportions two lots of material, neither of which is satisfactory for concrete roads if used alone. The mixing of fine sand with a coarse sand or screenings from crushed rock of good quality is sometimes an economical procedure.

It seems probable that the grading of coarse aggregates exerts an important influence, although the rela-

tive variation in grading is generally much less than in natural sands.

The earlier builders of concrete roads used coarse aggregate graded from about $\frac{1}{4}$ to 1 or $1\frac{1}{4}$ inches. It has long been recognized that concrete of greater density and strength can be produced by using coarser material. A saving in the cost of crushing can be effected by using aggregates as coarse as the nature of the work will permit. With the richer mixes that are now common in concrete road construction no difficulty is encountered in placing and finishing roads with aggregates graded up to 2 inches. It is believed that this size of material will produce a superior concrete for use in a one-course road. In two-course construction or where required by local conditions of supply, finer material may be used.

In certain instances it may be desirable to consider fine aggregate as material graded up to $\frac{1}{8}$ inch instead of $\frac{1}{4}$ inch. In this case corresponding changes must be made in the specification requirements for the grading of aggregates and in the proportions used. The use of fine aggregate graded up to $\frac{1}{4}$ inch is recommended.

Owing to the wide variations in practice in screening coarse aggregates, it does not seem feasible to specify the sizes to be required, within too narrow limits.

There is great need for a standardization of sieve sizes and of the methods of conducting sieve tests both of fine and coarse aggregates.

The voids in aggregates are largely a function of the shape and grading of the particles. Low voids should be secured, since the strength and "workability" of the concrete will thus be greatly improved. A well-graded natural sand will show voids as low as 28 per cent; in a poorly graded sand the value may be as high as 38 per cent. The voids in crushed stone frequently run to 50 per cent.

Cleanness.—The impurities in aggregates generally consist of clay or loam. The presence of a small percentage of clay in a loose, finely divided condition is not usually found to be harmful. Clay which coats the particles is likely to prove injurious. A large percentage of clay in sands or gravels suggests the presence of clay pebbles. The presence of vegetable loam or other organic materials always has a deleterious effect. Mica in sand reduces the strength of the mortar. The possibility of the presence of other impurities should not be disregarded.

The term "silt" is used to designate all foreign material which may be present in an aggregate in the form of a coating on the grains or in a finely divided state, or which is of a soft or soluble nature. It is in tests of natural sands that a study of the silt is most important. Various methods of determining the amount and nature of the silt are in use.

(To be continued)

SCREENS FOR GRAVEL WASHING AND SCREENING

By Arthur F. Kretzer

Cement and Engineering News during the past six months has received numerous inquiries regarding the relative merits of gravity and revolving screens. In an effort to answer these many inquiries the writer has prepared the following:

The method of screening and type, size and arrangement of screens depend very largely upon the character of the pit-run material, the grades of material it is intended to produce and whether or not the material is to be dry screened or screened with water.

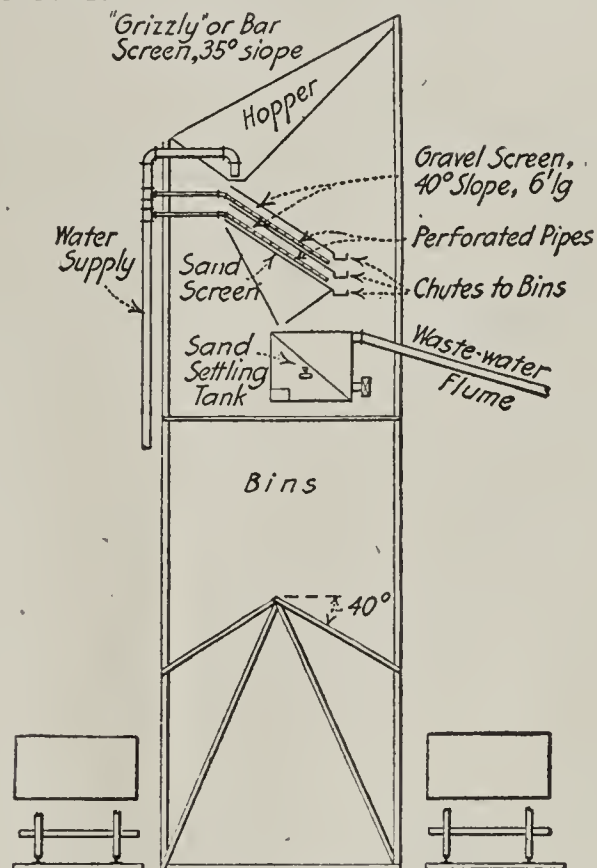
Dry Screening.—It would seem hardly necessary to call attention to the fact that it is practically impossible to screen dry material by means of gravity screens.

The revolving cylindrical screen is the only type of screen suitable for dry screening and its effectiveness will largely depend upon the amount of moisture in the material and the percentage of sand in the gravel.

With dry material not containing an excessive amount of sand, fairly good results may be obtained. If the material is moist or wet and the percentage of sand high, however, dry screening will prove anything but satisfactory. Wet and rainy weather also has its effect upon dry screening; in many cases making it impossible to screen at all during such weather.

Gravity Screens.—Where the material is excavated from a wet pit, such as rivers and creeks, and reasonably clean, a very fair degree of screening can be obtained with the simple inclined gravity screen, provided plenty of water is used on the screen plates.

Gravel taken from below water is apt to be quite clean and free from that hard, argillaceous matter so often found firmly cemented to the gravel of dry deposits. This is not always the case, however, and an examination and test of the material should be made to ascertain whether or not the gravel can be effectively washed, before any attempt is made to use gravity screens.



SKETCH SHOWING ARRANGEMENT OF GRAVITY SCREENS

To produce the best results with the gravity screen the gravel should be composed of well rounded stones. Even under such favorable conditions, however, the percentage of oversize material in the several grades produced is apt to be quite high.

If the market requirements or specifications for the material will not permit of at least 10% oversize, gravity screens should be adopted with caution. If the deposit contains a very large percentage of long, flat, angular stones, it is going to be practically impossible to screen material without a very large percentage of oversize.

Where the above conditions are favorable and the specifications for the material will permit, the gravity screen is the simplest and most economical one that could be used. An objection to this screen is that it is practically impossible to take out or separate all of the sand from the gravel, at least 10% or 15% of the sand going in with the gravel, even under the most favorable conditions. Where the requirements, however, are for a road gravel or what is known as a concrete mix, in which a certain percentage of sand is required, this objection does not obtain, and a very

fair grade of such material can be produced with this type of screen.

The accompanying sketch shows a very effective gravity screen arrangement used in connection with a dragline cableway excavator. The material is dumped by the excavator directly upon the grizzly or bar screen, the material rejected by this screen going to the crusher or waste pile. The material going through the bar spacings is fed directly from the hopper to the screens.

While the usual practice is to discharge the entire water supply for washing directly upon the material in the hopper, much better results have been accomplished by delivering at least one-half of the supply directly upon the screens by means of perforated pipes. The purpose should be to keep the water with the material as long as possible, for the moment the water leaves it, screening ceases, the material simply sliding over the screen plates.

In sliding over gravity screens, the material acquires a velocity in a very short time that prevents it from going through the perforations. For this reason only the first 5 or 6 ft. of the screen is effective. Nothing is accomplished, therefore, in using screens longer than 6 ft.

It is advisable to make the screens in sections so as to permit of easy handling. The screens should also be at least 2 ft. apart so that repairs and renewals of any of the sections can be easily and quickly made without disturbing the other screens.

The initial screen should be a bar screen. The sizing screens should be of either heavy, square mesh wire or perforated metal. If perforated metal is used, the perforations should be spaced somewhat closer together than is ordinarily the practice in a revolving screen plate.

Sand Screens—Gravity Type.—A great deal of trouble is usually experienced with the sand screens, the main difficulty being to prevent the screen from clogging. The shape of the sand grains, whether round or long and angular, shape and size of screen perforations, manner of applying water to the screen, amount of water and inclination of the screen, all have their effect upon the efficiency of the screen.

If the sand grains are round, such as are most river sands, it is generally advisable to use a slotted perforated plate for the sand screen, as with round or square perforations the screen is very likely to clog up. If the grains are long and angular, however, such as are a great many bank sands, it is generally advisable to use a round perforation in steel plate or a wire mesh screen. For this purpose No. 11 wire for the coarse and No. 16 wire for the fine sand screen have proven effective.

Amount of Water Required—Gravity Screens.—The amount of water required varies, of course, with the amount of impurities in the gravel, but where this method of screening can be used at all a supply of at least $1\frac{1}{2}$ gal. per min. per cu. yd. of material screened per day should prove effective. A larger amount of water is required with the gravity screen than with the revolving screen; but inasmuch as an ample water-supply at comparatively low cost is generally assured where wet material is being handled, this feature is of no particular importance.

Settling Tanks.—The sand is separated from the dirty water by means of settling tanks which permit the dirty water to flow off, the sand discharging itself through an opening at the bottom. The practice of spouting the sand and dirty water to large open storage basins and permitting the dirty water to escape by flowing through and over the sand results in a very dirty sand, the action being similar to that of a sand filter.

The writer would not recommend the use of gravity screens for washing and screening bank or dry material, as he has yet to see a gravel from a dry deposit that could be effectively washed and screened by means of gravity screens.

Revolving Screens.—Where the clay, loam or other impurities in the gravel can be easily washed out, any one of the several types of revolving screens will produce satisfactory results, so far as screening and washing of the material is concerned.

If the material is very dirty, however, and the gravel covered with a hard film of dirt, effective washing is impossible in any screen. In such cases some form of preliminary washing and scrubbing is absolutely necessary before the material is permitted to enter the screens.

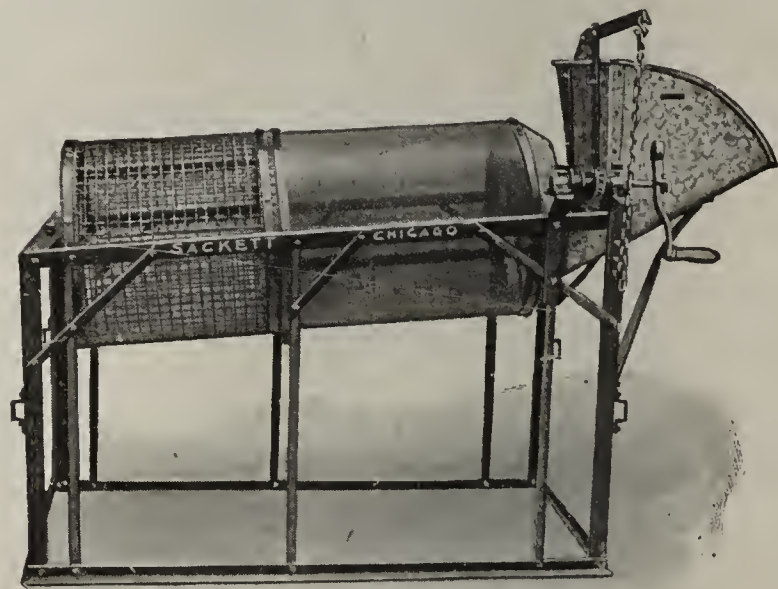
One of the most effective of these washing and screening units, of which there are many in successful operation, is the patented screen and washer manufactured by the Raymond W. Dull Co., 1916 Conway Bldg., Chicago.

SACKETT PORTABLE ROTARY SCREENS

There are many opportunities for a contractor to cut the costs on concrete work if he can screen material that is near at hand to secure the gravel and sand that are needed for the work. Also if a contractor has a screen, there will be less tendency to use bank-run with its accompanying uncertain quality of concrete.

The accompanying illustration shows a screen that is particularly convenient for the contractor which can be run at a small cost and is low in initial cost. The screen can be either operated by hand or by power.

The screen cylinder is made in sections, each of a



differently spaced wire cloth. Each section is made into two interchangeable parts so that different sized screens can be inserted.

The makers, the H. B. Sackett Screen & Chute Co., 1679 Elston Ave., Chicago, say that the roughness of the screen that is used holds the material long enough so that screening is insured.

More complete details and descriptions can be secured by writing to this company.

SCOWS BUILT OF CONCRETE

Scows A. S. and G. Company Nos. 33 and No. 66 were built of concrete at Fairfield, Md., in 1912 and 1913, respectively, by the Arundel Sand and Gravel Company of Baltimore, Md. These vessels measure approximately 112 feet in length and 28 feet in beam, and it is believed they are the first vessels ever built of concrete. The No. 66 was abandoned as unfit for service in the early part of the current year and the No. 33 is still in commission.



Bungalow of Mr. Edgar W. Smith, Madison, Wisconsin, Covered with Concrete Roofing Tile.

Concrete Roofing Tile

One of the most perplexing problems to solve in buildings of all kinds is a durable roof of medium price. There are cheap roof coverings which will give temporary service, but a roofing material which will not disintegrate under the destructive action of the elements and yet be economical in cost and present an artistic appearance has been a long felt want.

The ever increasing and varying uses to which concrete is adapted has proven that it is the ideal building material for every purpose. Its superiority and advantages are being realized more and more fully every day. It is recognized as the only building material that does not deteriorate with age and exposure, but, on the contrary, increases in strength and thereby proves its indestructibility.

A company recently organized in Indianapolis has placed upon the market a roofing tile machine, protected by United States patents, which is a very practical machine, by which this ideal building material can be manufactured into roofing tile which are fire-proof, storm-proof, water-proof, indestructible, and which can be put on more easily than shingles.

A plant for the manufacture of concrete roofing tile will soon be in operation in Grand Rapids, according to the Grand Rapids Daily News, which recently published the following item:

"In the above pictures is shown Grand Rapids' newest industry, the Hine Concretile company and two views of operation in the manufacture of this new roofing material. The Hine company's plant is situated in Madison avenue and adjoins the plant of the National Brass company. The building was secured through the activities of the Madison Square board of trade.

"The manufacture of Concretile bids fair to grow into an industry of unusual proportions and the Hine company brings to Grand Rapids the distinction of having the only similar plant in Michigan. With the already large output of asphalt shingles, Grand Rapids can now lay claim to being the state's leading roofing

material center, if not the leader in the middle west, with the exception of Chicago."

Concretile is the most economical, attractive, permanent, fireproof roofing in existence. It has been a standard roofing in Germany for more than twenty-five years. Concretile is an interlocking cement tile manufactured with special machinery patented by Mr. Otto Walter, 418 Oaks Building, Indianapolis, Ind., who transplanted this business from Germany about nine years ago. The manufacture of Walter Concretile is now a national industry in this country. Within the last 8 months large plants have been established in many of the leading cities. All operating plants have business booked ahead—the demand is universal.

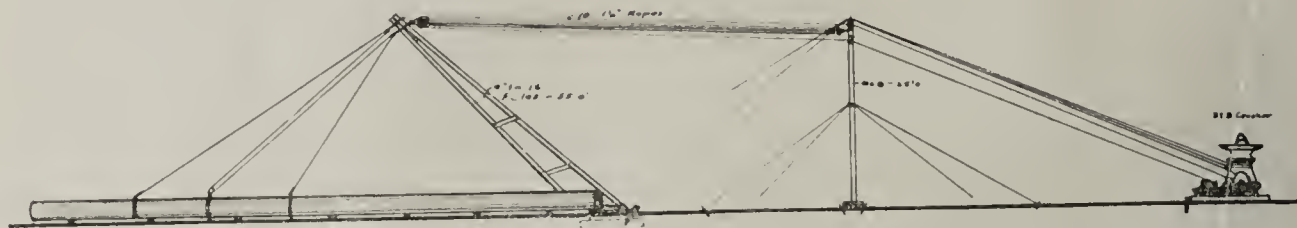
The Hine company's plant is now turning out about 1,500 tile per day. It is expected that this will be increased within a few months to a daily output of 2,000 tile. A large warehouse is being constructed in the rear of the present building for curing space, in addition to the large yard facilities. A. W. Hine is proprietor of the business and the output will be exclusively sold in Michigan by the Floyd Construction & Supply Company.

Concretile is a newly coined word resulting from the combination of the words "concrete" and "tile" and has been copyrighted by the Walter Concrete Machinery Company, 418 Saks Bldg., Indianapolis, Ind., and licensed only for use in connection with the roofing product manufactured on machines sold by the Walter Concrete Machinery Company. This company controls patents on the machine and process of manufacture of the roofing tile.

The incorporators of the new Hine company are enthusiastic in having acquired the rights for the manufacture of "Walter Concretile" in this section of Michigan, and they intend to make this roof the standard fire-proof roof in Grand Rapids as it has become elsewhere.

OTTAWA STONE AND SAND CO. ERECTING NEW PLANT

The erection of a 110-foot steel smoke stack for the Ottawa Stone and Sand Co. of Ottawa, Ill., which plant is now under construction, the contract of which was awarded to Theodore Ahlborn, 666 Peoples Gas building, Chicago, is offering to the readers of this magazine an exceedingly interesting job, consisting of the raising of a steel smoke stack, as illustrated in line cut below.



Raising a steel smoke stack at the new plant of the Ottawa Stone and Sand Co.

The dimensions of the stack were as follows:

110 ft. overall length

60 in. diameter

Thickness of shell as follows:

1st third of the length $\frac{3}{8}$ " thick

2nd third $\frac{5}{16}$ "

3rd third $\frac{1}{4}$ "

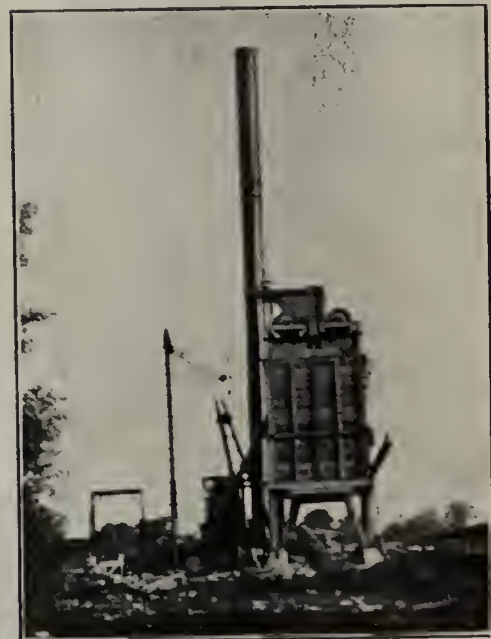
The stack came in six sections of about equal length. These were laid in line with the base of the bottom section as close as practical to the foundation, and riveted together on the ground. The foundation which

two equal parts, the five-part block being part of the tackle doing the final hoisting.

To equalize the pull and variation of the length of these cables while the stack was being raised, a single block was fastened to the smoke stack located half-way between the two outside cables.

However, these connections of cables were made while the 'A' frame was laid out alongside with its base against the foundation of the stack.

The hoisting rope used was $1\frac{1}{8}$ " in diameter manila transmission rope of a total length of about 1,400 feet. This was pulled through the blocks, anchoring one end of same to the crusher, the other end leading to the hoist.



projected 12" above the ground, which projection was made round and smaller in diameter than the inside of the smoke stack to assure a loose and easy fit.

After being riveted and lined out and painted, the stack was provided with straps and slings for receiving the wire cables.

There were no braces or re-enforcements on the inside of the stack, with the exception of the section nearest to the base, which had an opening cut in the same for receiving the flue box from the boiler. Here three braces in the shape of a cross were used.

The next step was to place the hoisting plant. A single drum-hand hoist was located on the foundation of a No. 5 gyratory crusher and an 8x8 pole 35 feet long was erected about two-thirds of the distance from the foot of the stack to the crusher. This pole had eight guy wires anchored to the ground and to the crusher, as may be seen from sketch. At the top of this pole there was fastened a four-block shackle and two snatch blocks with large sheaves for $1\frac{1}{8}$ " diameter rope.

At the smoke stack two 55-foot 8" to 16" telegraph poles were used, having been braced horizontally and bolted together in the shape of an 'A' frame, and laid out alongside the smoke stack.

On the top of this 'A' frame there was fastened a five-block shackle and one double block for cables leading to the smoke stack. These cables were fastened at the top half of this stack, dividing same in about

The first and last line of these ropes were led over snatch blocks on the 35-foot pole, with eight ropes pulling direct against this pole.

With everything ready, as described above, the hoisting was begun by four men, two on each side of the hoist.

The 'A' frame was raised into a position of 45 degrees to the horizontal before the raising of the stack commenced.

The largest stress occurred in all cables and ropes at this point, and if the theoretical calculations of the stresses would not have been correct, the rigging would have broken down at that point. As there was no fault visible, the hoisting was continued and in three hours' time the smoke stack was in place with all guys temporarily fastened.

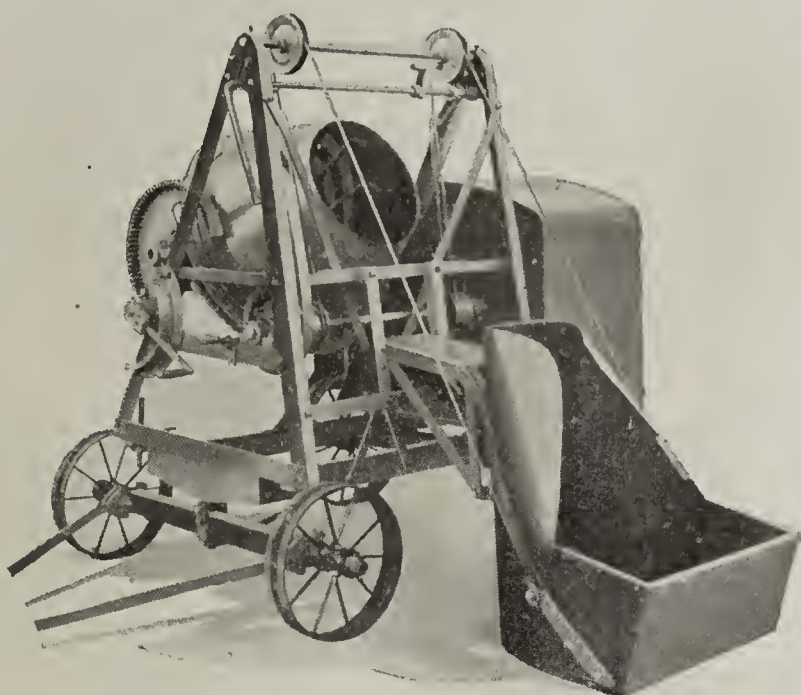
The cost of the work described was not kept in such a way that it can be itemized, but the total cost, including the riveting, painting, erecting of the masts and raising and fastening of guys, not including any material, was one hundred and seventy-five dollars (\$175).

The foreman on the job, who is an expert millwright, was paid 75 cents an hour and common labor 35 cents per hour.

The erection as described was planned and personally directed by Mr. Theodore Ahlborn, who is a practical and experienced engineer and contractor, making a specialty of mines and quarries.

JAEGER MIXERS of 1917 are NOW ANNOUNCED

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SEE US AT
THE CHICAGO
CEMENT SHOW

Changes in design and construction of the automatic side loaders have been made to simplify and better same.

Mixers now go to you all set up ready to use.

Weight has been reduced by using steel instead of cast iron.

Conical—Revolving—Tilting Drum type of mixer with the best known labor saving devices causes the Jaeger mixers to be recognized the LEADER of all makes.

THE JAEGER MACHINE COMPANY 212 W. RICH STREET
COLUMBUS - OHIO

High-Grade, Low-Priced Drum Mixers

Backed by Austin Engineering

When it comes to volume, rate and quality of output, working life, low maintenance cost and simplicity of operation, we invite your most rigid inspection of the design, construction and performance records of

Austin Drum Mixers

The charging arrangement is a hinged funnel-shaped steel plate hopper, which when lowered can be filled at ground level from barrows. For discharging into the mixing drum the hopper is elevated by a simple cable hoist.

A hand lever operates the swinging discharge chute. During the mixing operation the chute is set in such a position as to avoid any possibility of catching and discharging portions of the batch, yet by a simple manipulation of the chute the whole batch or any portion can be discharged at one time. All operations are controlled from one position.

Equipped with hopper cooled gasoline engine in steel housing. Capacities 4½, 6½ and 10 cu. ft. of mixed concrete.

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Send me catalog No. 21-D. I want to know more about high-grade, low-priced drum mixers and pavers made by the builders of Austin Improved Cube Mixers.

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CONVENTION OF THE AMERICAN ROAD BUILDERS' ASSOCIATION

The Fourteenth Annual Convention of the American Road Builders' Association, 150 Nassau Street, will be held in Mechanics Building, Boston, Massachusetts, during the week beginning February 5, 1917. The program, which is in course of preparation, will include papers and discussions on subjects connected with road and bridge building and street paving by the foremost authorities of the United States and Canada.

In connection with the convention, and in the same building, will be held the Eighth National Good Roads Show. This exposition will include exhibits by leading manufacturers in the United States of the machinery and materials used in road and paving construction and maintenance.

This exhibition, which has been a feature of the

tured 27,000 concrete blocks, 8x8x16, last year and used Sandusky Cement and Medusa Waterproofing in the facing of the blocks.

CONCRETE BURIAL VAULTS

The illustration on this page shows cement burial vaults as manufactured by Mr. W. H. West, Mt. Vernon, Ohio. These reinforced cement burial vaults are manufactured with Medusa waterproofed gray Portland cement. Mr. West uses this brand of cement exclusively because it is more plastic, easier to handle and because of its remarkable waterproofing qualities.

Mr. West also makes concrete building blocks. He uses a Monarch block machine and a Monarch tamper, made by the Monarch Manufacturing Company, Boone, Iowa.

The manufacture of concrete burial vaults is a proposition every cement contractor should be interested in.



Watertight Concrete Burial Vaults Made by W. H. West, Mt. Vernon, Ohio.

American Road Builders' Association conventions for a number of years, has increased in size and interest year after year. The coming exhibition takes on added importance on account of the enormous sum of money appropriated under the recently enacted Federal Aid Law and the additional large sums to be expended for road building by the various states and smaller units of government.

Mechanics Building, in which the Convention and Good Roads Show will be held, is admirably situated and fully equipped for the purpose. It is located on Huntington Avenue, within convenient distance of the leading hotels and business district of Boston. The building is well lighted and heated, and is thoroughly modern in its appointments. It contains ample space for practically any number of exhibits, and is adaptable to exhibits of any size, as the floor plans just published indicate.

The management announces that the services of Mr. H. G. McConnaughy have been secured as Director of Exhibits. Mr. McConnaughy has had many years' experience in this line of work and is well known in connection with the management of the exhibitions held under the auspices of the American Electric Railway Manufacturers' Association.

CAREFULLY MADE WATERPROOF CONCRETE BLOCKS ALWAYS IN DEMAND

Twenty-eight milk houses have been built by the Cement Products Construction Co., Walworth, Wis., all of which are giving the best of satisfaction.

The Cement Products Construction Co. manufac-

He can make money during the winter just as well as during the building season. It doesn't cost much to start in this business, and it's steady the year around. Chas. F. Russell, Greenbush, Va., started manufacturing concrete burial vaults three years and a half ago. He uses adjustable steel molds manufactured by the Automatic Sealing Vault Company, 216 East River street, Peru, Indiana. The first year he sold thirty-eight vaults, the second year 108 vaults, the third year 162 vaults, and this year is averaging a vault a day.

Last year his net profit was better than \$3,000.

MODERN LABORATORY FOR CONCRETE MATERIALS

Sanford E. Thompson, consulting engineer, announces the opening of his new offices and laboratory in the Federal Street Building, Boston.

Association in a consulting capacity with large and important constructions in reinforced concrete and steel, and many cases requiring particular advice and decisive reports on materials, methods, cost analysis, and economical plant operation, have peculiarly fitted Mr. Thompson's organization not only for ordinary design and construction and tests, but for investigations involving complex problems.

His laboratory equipment has been developed as a result of a great number of special cases requiring apparatus—such, for example, as a concrete saw and a 125-ton compression machine—not usually found in laboratories making only routine tests, which renders it possible to handle work of an original nature.

STREICH Dump Wagons



1. Chicago Second Regiment Armory Job.
W. J. Newman, Contractor.

2. Chicago Lake Front Improvement.
The Ryan Co., Contractors.

¶ About 90% of the Dump Wagons purchased in the City of Chicago are Streich's. There is a reason. Our wagons run easily because the axles are properly set, and wear long because they are made of the right kind of stuff.

¶ This wagon will dump anything from cinders to the stickiest kind of clay. Weight of contents of load when dumped automatically forces the bottom doors up the sides of body, allowing bottom doors to clear pile. You never see a Streich wagon stalled and you never see a driver shovel in order to get free after a dump.

¶ We build One and Two Horse Wagons from one yard to four yards capacity.

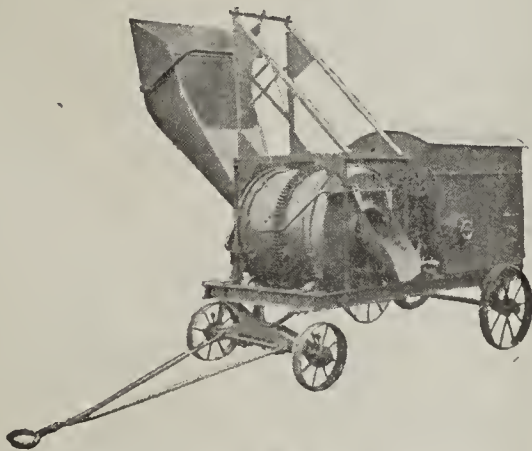
Write for catalog showing complete line of Dump Wagons, Garbage and Asphalt Wagons.



A. STREICH & BRO COMPANY OSHKOSH, WISCONSIN.
CHICAGO OFFICE: 563-565 WEST LAKE ST.

LANSING FIVE

- Rotary Pump
- Side Loader
- Ideal or Novo Engine
- Gear Driven
- Folding Platform



- Silo Hoist
- Batch Hopper
- Water Tank
- High Wheels
- Wagon Tread

THIS MIXER MUST EXCEL

It has been a positive necessity for us to make the Lansing Five the best mixer in the world at anywhere near its price. We went into the business of making mixers knowing that the field already was well filled, that many concerns were making good mixers and selling them at reasonable prices. But, backed by a great thirty-five year old concern with a paid-up capital of \$1,500,000 and a world-wide reputation, we entered the field with a reputation and standard to uphold, not with a reputation and standard to create. So, obviously, we had to build a mixer which would stand head and shoulders above everything else in its class. We were forced to make the Lansing Five excel —AND IT DOES.

Write for Catalog 354-M

LANSING

::

MICHIGAN

WAREHOUSES:

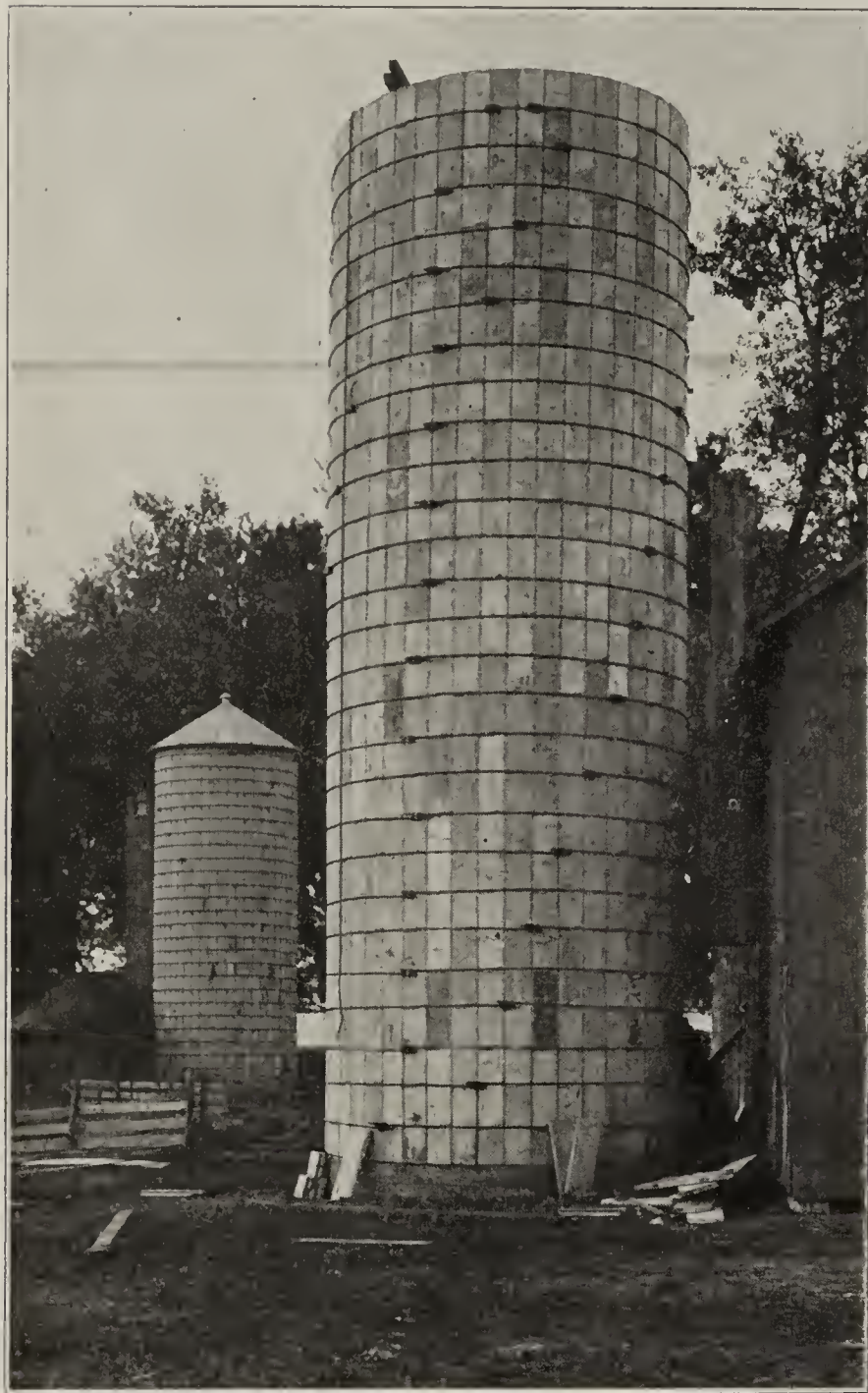
CHICAGO, 169 W. Lake Street MINNEAPOLIS, 517-519 N. Third Street
NEW YORK, 288-289 West St. PHILADELPHIA, N. American & Willow
KANSAS CITY, 1413-1415 W. 10th St. SAN FRANCISCO, 338 Brannan St.
BOSTON, 78 Cambridge Street, Charlestown Dist.



A REAL INTERLOCKING JOINT IN STAVE SILO CONSTRUCTION

The value of a stave silo depends to a large extent on the joint that is maintained between the staves, both at the ends and at the sides. If the joint is not perfectly tight and interlocking the silo cannot be as strong or as satisfactory as it should be.

The silo illustrated here in the process of construction is built with staves made on the equipment of the Co-operative Concrete Construction Company. This concern have a joint between the staves that should give complete satisfaction. The ends of the stave are offset $1\frac{1}{2}$ inches and are tongued and grooved at both the sides and the ends. The offset gives a very strong, rigid joint that will brace the walls, and yet is flexible



Concrete Stave Silo in the Process of Construction.

enough so that expansion and contraction can be accommodated.

The outside of the staves is made slightly convex for a very good reason. It allows the iron bands to fit closely against the staves and not to touch merely at the corners so the resistance to expansion and contraction will not cause breakage. The bands are placed around the silo 15 inches apart so that each stave is held on by three bands.

The manufacturers of this equipment, the Co-operative Concrete Construction Company, are located at Oskaloosa, Iowa. They will be glad to furnish further details on request.

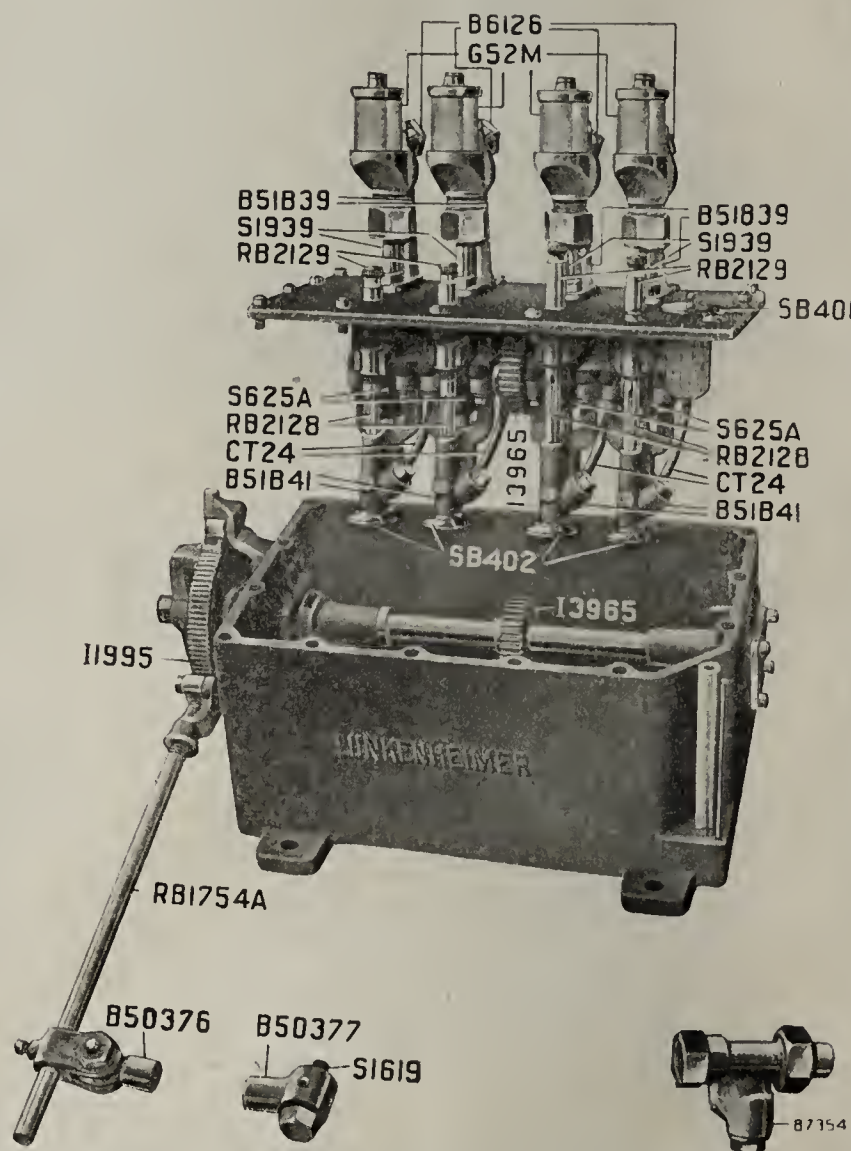
A NEW DESIGN OF MECHANICAL OIL PUMP

The oil pump herewith shown was designed for the lubrication of stationary and portable steam or Diesel oil engines and air compressor cylinders.

The manufacturers exercised great care in the selection of the materials used in the construction of the pump, the object being to employ the most durable materials for the performance of the different functions. The body, lid and driving wheel are of close-grained grey cast iron; operative parts subjected to the greatest wear, such as the ratchet wheel, eccentrics, pawls, etc., are of hardened tool steel, and the bearings and other parts are of a high grade bronze, the composition varying according to the service the part performs.

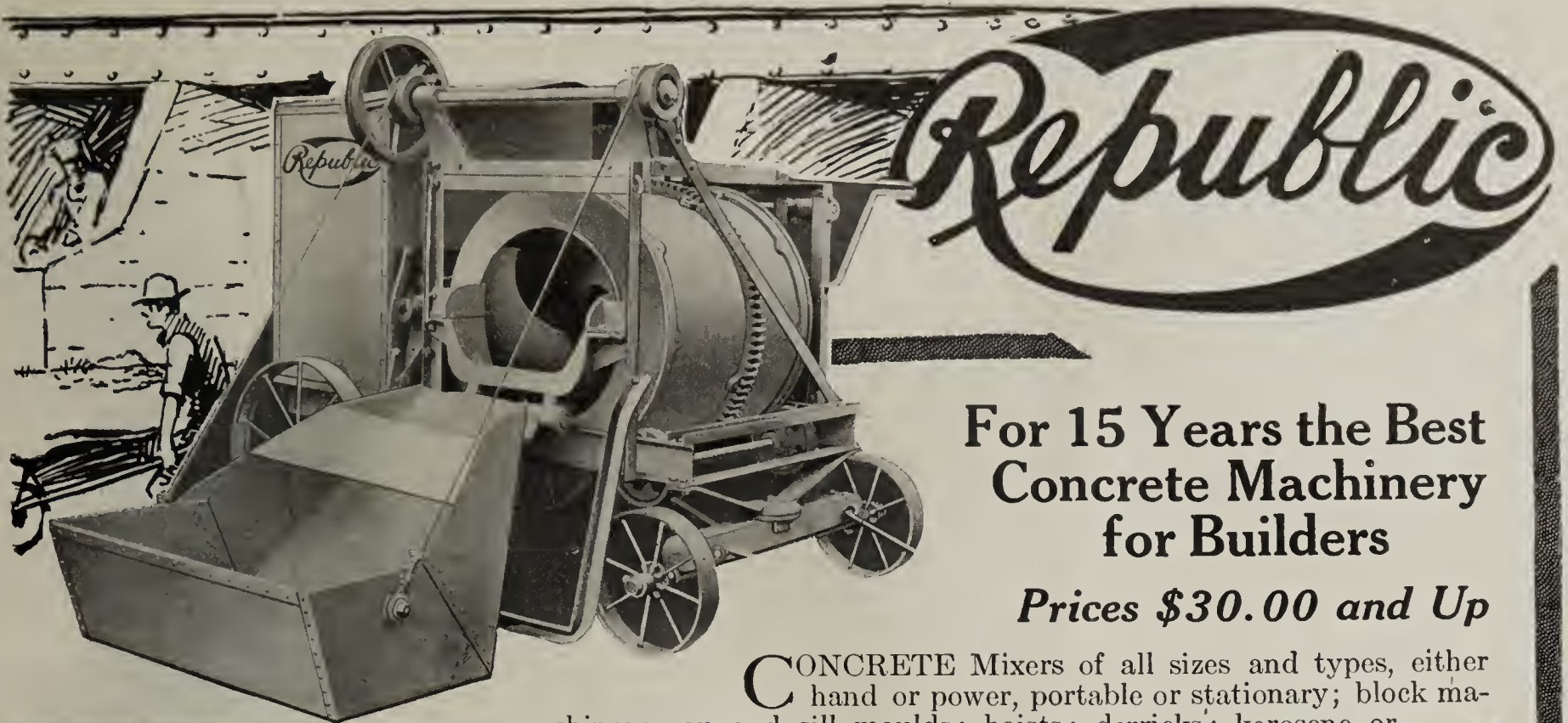
As practically all operative parts are within the body and either immersed in oil or automatically lubricated, the greatest durability possible is attained.

From the illustration herewith, some idea as to the convenient accessibility can be had. Practically all parts are attached to the lid, so that upon the removal of the lid, the parts naturally follow, facilitating inspection or repairs.



"Invincible" Oil Pump of the Lunkenheimer Company.

The operation is as follows, reference being had to the accompanying illustration: Engine Link B-50377 is attached to eccentric rod or other moving part of engine and connected to link B-50376 by a rod of proper length. Line check B-7354, threaded for $\frac{1}{8}$ -inch pipe, is furnished for every oil outlet on pump and is attached as close to the steam pipe as possible. The position of the link B-50376 on rod RB-1754A, governs the arc of travel of ratchet wheel I-1995. Gear I-3965, revolving with ratchet wheel I-1995, imparts motion to pump plunger through the mediums of gear I-3965 on eccentric shaft and eccentrics S-625A. Auxiliary plungers being suitably connected with force pump plungers, move in unison therewith. On the up-stroke



For 15 Years the Best Concrete Machinery for Builders

Prices \$30.00 and Up

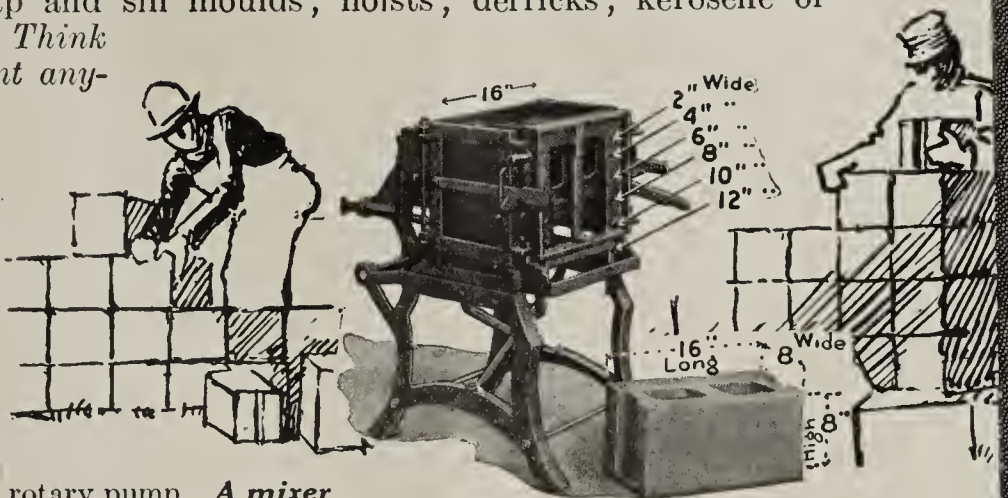
CONCRETE Mixers of all sizes and types, either hand or power, portable or stationary; block machines; cap and sill moulds; hoists; derricks; kerosene or gasoline engines; tools, etc. Think of "Republic" when you want anything in the concrete machinery line.

Republic "Ten"

See this splendid new 1917 model light weight sack size mixer. Can be furnished with either low charging portable platform or automatic power loader. **The best light weight sack size mixer built.** Prices very low.

Republic "Seven"

A medium size mixer of standard design. Equipped with standard hopper, batch hopper, power loader, building hoist, or rotary pump. **A mixer built for service and durability.**



Republic "Five"

An extremely strong and durable medium and small size mixer. One of the best building and small contractors' outfits built. Silo and building hoists, rotary pumps, standard hopper, loader or any equipment you want. **Don't fail to see this mixer before you buy.**

Republic "Three"

A new model mixer for the small contractor and builder. **Lowest prices** combined with long wearing qualities, with convenience in operating and extreme portability. **\$30 and up.**

Monarch Cement Block Machine

Simple, rapid, face down, easy to operate. Adjustable to all standard widths from 2 to 12 inches. Makes blocks with faces in rich effects imitating rock, ornamental stone, etc. **Considered the standard of building block machines.**

Systematic

An automatic proportioning mixer with batch principle of measuring. A splendid machine for sidewalk, curb and gutter, and block and tile plants. Built in four sizes, with or without power.

Illustrated Catalogs Sent on Request

Stocks and dealers at all important cities. Get posted today!

Republic Iron Works
116 Patterson St., Box 454
TECUMSEH, MICHIGAN



of auxiliary plungers, oil is drawn through strainers in bottom of holders SB-402, into auxiliary cylinders B-51841, from where it is forced on downward stroke through tubes CT-24 and passage in parts B-51839 to sight-feeds G-52M. As the oil drops through the sight-feeds, it is drawn into force pump cylinder on the downward stroke of the plungers S-1939, from where it is forced upon the upward stroke through unions B-6126 to the cylinders to be lubricated.

The quantity of oil desired fed is regulated outside the body by auxiliary pump plunger extension stems RB-2129.

Regardless of the level of oil in reservoir, the lubrication of such parts within the body constantly requiring same, is automatically taken care of by an arrangement provided at the bottom of the force pump plunger.

The pump operates only while the engine is running, and automatically feeds more or less oil according to the speed of the engine, consequently there is no waste of oil.

Every outlet is provided with a sight-feed. These sight-feeds are large, will not become oil splashed and the dropping oil can be plainly seen from a distance.

Independent feed regulation for each outlet is also provided. They can readily be adjusted without the use of tools or the removal of any of the parts.

The filling hole is quite large for convenience in filling. A sliding cap, to prevent dirt from entering, is provided, and within the opening is a bronze strainer which can readily be removed for cleansing.

The pump can be had with from one to four feeds, the one-feed having a capacity of one quart or half-gallon, the two-feed, half gallon or one gallon, and the three and four-feed, one gallon.

The Lunkenheimer Company, of Cincinnati, Ohio, are the manufacturers of this new pump, which they have given the trade name of "Invincible." An attractive booklet, fully descriptive, will be sent upon request.

ARCTIC NON-FREEZING EXPLOSIVES

Arctic explosives which we are now prepared to manufacture in unlimited quantities are non-freezing under the most severe winter conditions. They are quite water resisting but should not be used in submarine work. They can be used in driving tunnels, shafts or other close work, as the fumes given off on detonation are not obnoxious and will not cause headaches. They can be furnished in all standard size cartridges. If necessary, they can be packed in bulk, in paper bags which are in turn enclosed in wooden

cases. To properly detonate them nothing less in strength than a No. 6 (Red Label) detonator may be used.

Arctic is made in five different strengths which on a weight for weight basis are as follows:

Arctic No. 3 is equivalent in strength to a 60% dynamite.

Arctic No. 4 is equivalent in strength to a 45% dynamite.

Arctic No. 5 is equivalent in strength to a 40% dynamite.

Arctic No. 6 is equivalent in strength to a 30% dynamite.

Arctic No. 7 is equivalent in strength to a 25% dynamite.

They can be used in work such as quarry blasting, tunnels, shaft sinking, mining, subsoiling, tree planting, stump blasting, ditching by the electrical method, breaking up ice jams and many other kinds of work.

If you have not tried them and desire further information, write our Technical Division, which will be glad to give you all assistance possible.

Arctic powders contain no nitroglycerine and are therefore materially cheaper than straight or extra grades. Their velocity of detonation is even quicker than straight dynamites.—Du Pont Magazine.

CONCRETE ROADS

Finishing concrete roads by dragging heavy belting across the surface has recently been tried out in Wayne county, Mich., where the method of using the belt is as follows: three pieces of heavy belting about 10 inches wide and cut a few feet longer than the width of the road are used. The first is seesawed across the road as soon as the template has been used. The second belt is used in a similar manner but not until the water has just disappeared from the surface. After the concrete has stiffened somewhat, the third belt is run over the surface and leaves a fine grained, coarse, gritty texture.

On the Fremont-Port Clinton road in Ohio contractors are using a strip of eight-ounce canvas 24 inches wide and 18 feet long in much the same manner.

These finishing methods are apparently outgrowths of one practiced in California where a strip of pliable redwood three-eighths inch thick, of suitable width, has been used to finish a concrete road surface. Although the value of these methods has not been demonstrated beyond dispute indications are that they will prove to be more economical and satisfactory than hand floating.

SAVE FOUR-FIFTHS OF YOUR LABOR BILL for Surface Finishing



—It takes five men doing it the old way to equal one man using

ABRAM LONG HANDLED TOOLS

Hundreds of finishers who use Abram Tools will prove this to you. The secret is the Abram Double Action Device. Send for Catalog.

Visit our exhibit at the Chicago Cement Show, Booth 120 Main Floor, and at Kansas City, Lot 28, Main Floor

ABRAM CEMENT TOOL CO., McNair Building., DETROIT, MICH.

**"YES SIR!
You've Got to Reduce
Your Production Costs
or your Block
Business
Won't Pay!"**



The building industry has outgrown the old methods of making concrete blocks. Modern multiple molds for casting blocks have taken the place of slow and crude methods. The day of the dry tamp sand process block has passed—people are demanding the stronger and better looking granite faced cast stone block that is absolutely waterproof. Block plants that have managed to get along with poor equipment and high labor cost are now turning to THE ZAGELMEYER SYSTEM as the means of making more money, of cutting down production costs and increasing the capacity of their plants.

You Can Make More Blocks and Better Blocks if You Equip Your Plant with Multiple Molds

Zagelmeyer Casting Molds mounted on all-iron roller-bearing trucks solve the problem of increasing your production and making a better product. Think of casting twenty 24-inch blocks at one time as compared with the old method of turning out single blocks. Consider what this means from a labor standpoint. Then look at the matter from a sales point of view. With the Zagelmeyer System you can make blocks that are trouble-proof. No kicks or complaints that you must make good. Zagelmeyer Cast Stone Granite

Faced Blocks stand the test of time—there's no pores to absorb water and moisture and the surface is hard as flint. You can make either rock face or plain face blocks by the Zagelmeyer process with a rich, beautiful, sparkling surface of pure granite and you can make these blocks at less than it costs you to make dry-tamp blocks.



The First Step to Bigger Profits is Sending for this Book of Cement Block Facts



Just Slip This Coupon in an Envelope

We Want You to Inspect One of Our Blocks

Send 50 cents for sample of Granite Faced Cast Stone Block, shipped prepaid to any point east of the Mississippi or north of the Ohio rivers.

Zagelmeyer Cast Stone Block Machinery Co.
Bay City, Michigan
Gentlemen:

I would like to know more about the Zagelmeyer System. Please send me your catalog and details about your territorial proposition, giving me the exclusive right to manufacture Granite Faced Cast Stone Blocks in my town for the life of your process patents.

ZAGELMEYER

Cast Stone Block Machinery Co.

25 CRUMP AVE. BAY CITY, MICHIGAN

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IRONITE FLOORING (FLOOR HARDENER) AND IRONITE WATERPROOFING PATENT UPHELD

Announcement has been made by the Ironite Company, 111 W. Washington Street, Chicago, Ill., of the successful termination of its litigation with The Master Builders Company, in the case of Ironite Company versus the City of Rockford and the Master Builders Company, in the United States District Court, Northern District of Illinois, Western Division, in Equity No. 30992; in which litigation the question of the validity of one of the patents owned by the Ironite Company was involved and the question as to whether or not the Master Builders' Method was an infringement of such patent.

A decree was entered in this case on November 10, 1916, sustaining the validity of said patent and holding that the Master Builders' Method was an infringement thereof.

The Master Builders' Method involves the use of metallic or metal-containing material in the treatment of concrete walls, floors or structures, for the purpose of indurating, hardening, waterproofing, dustproofing and wearproofing the same, and was the method practiced by The Master Builders' Company in the treatment of the floor and walls of the new reservoir at the city of Rockford, Illinois.

This case has been bitterly contested for more than four years, and the Ironite Company should be congratulated upon its outcome.

The Ironite Company will take the necessary steps to compel other manufacturers of and dealers in metallic or metal-containing material for use in treatment of concrete to obtain licenses under their patents.

The Ironite Company writes as follows: "These products are absolutely reliable. Other metallic hardeners and waterproofing materials owe their existence to the success attained by Ironite Flooring and Ironite Waterproofing. Unless you deal with the Ironite Company, or its licensees you are risking the possibility of a suit for infringement.

"Dealers and others are requested to write the Ironite Company, 11 W. Washington Street, Chicago, for our proposition."

SOUTHWESTERN CONCRETE SHOW

Arrangements are being made for holding the first annual convention of the Southwestern Concrete Association in Kansas City, Mo., February 19 to 24 inclusive, 1917. There will also be held in connection with the convention, a concrete show of which Charles A. Stevenson of 1413 West Tenth street, Kansas City, Mo., is the chairman. We understand that it is the expectation of the management to go into the convention with at least a membership of five hundred.

CONCRETE ROADS

At one time the town of Glasco, Kans., held the record for concrete pavement yardage compared with its population, which was 875. The recent award of 8,000 square yards of concrete pavement for the town of Hope, Kans., will take the laurels away from Glasco. Hope is credited with a population of 567.

EFFICIENT BURIAL VAULT PLANT

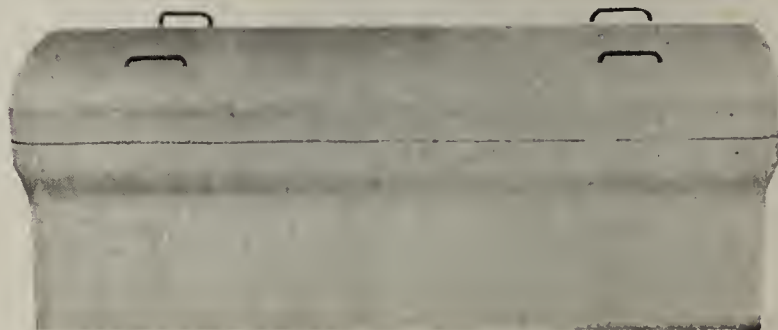
A plant which is ideally designed for the manufacture and handling of concrete burial vaults is that of the Chicago Cement Burial Vault and Casket Company, located at 5301 Ravenswood avenue, Chicago.

The building is 31 feet 9 inches wide, 127 feet long. Across the front is an exhibit room, 12 feet 9 inches deep, and between this and the main workroom are private office, coat room, closet, toilet rooms, vault, etc.

The workroom is almost 100 feet long and is covered with a concrete floor over the entire surface. There are no tracks of any kind in the floor, the principal method of handling the vaults and materials being by a chain hoist which travels on an overhead track. This track runs the greater part of the length and loops around so that practically the entire floor surface can be reached by it.

Under this arrangement, one side of the building is used for manufacturing purposes and the other side for storage, the hoist taking the completed vaults and covers from the forms and delivering them to the storage on the other side.

The forms for the vaults and covers are left stationary so far as possible. The cover forms require practically no moving as the covers are made top up and when they are cured sufficiently to move, they are lifted by the four hooks of the hoist. The manager states that both covers and vaults are made so dense that they can be moved in three days' time. The vaults themselves are made bottom up and have to be turned over, but this is also accomplished by the help of a crane.



The vaults are cast with four eyes extending up slightly above the inside surface of the bottom so that as soon as the vault is turned over the hoist is hooked into these eyes, making the handling very simple.

The storage space for the vaults is designed on somewhat unusual but very efficient lines. The space is divided into bays, each bay accommodating three vaults below and three covers above. All these spaces are provided with rollers so that it is very easy to slide the vaults and covers into place.

In taking them out for delivery they are loaded directly by the hoist from the storage bays onto a Standard motor truck. For this purpose the truck backs into the open space at the back of the work room and far enough to be reached by the hoist. This Standard motor truck has proven very efficient on this work.

The vault made by this company is of a special design of which Mr. John L. Janisch, manager of the plant, is the patentee. The cover is provided with a V-shaped tongue around the entire contact surface, this tongue fitting into a groove in the body of the vault. This groove is made slightly deeper and wider than the V-shaped tongue on the cover, and allowing space for cement grout to be poured as a seal.

The vaults are reinforced with expanded metal. The method of fastening the end and side pieces of the steel forms together is simple and most easily effected.

Ohio River Contract Company Breaks World's Concreting Record On Government Dam Work With a "Plymouth" Locomotive

The U. S. Government is building the longest movable dam in the world in the Ohio River, 18 miles below Evansville, Ind.—and the only one ever constructed on a shifting sand foundation. In its construction the contractors, The Ohio River Contract Co., is using two "Plymouth" Gasoline Locomotives, and these two little Giants have not only broken the world's concreting records but have cut them in HALF.

Read the Remarkable Figures in This Great Feat

The following figures are taken from a report made by Leslie P. Eichel, Secretary of The Ohio River Contract Co., of Evansville, Ind., and give an idea of the manner in which these two "Plymouth" Gasoline Locomotives have speeded up the work:

"The 'Plymouths' operated maximum round-trip of 1600 feet, with stop for loading concrete at mixer and for dumping material. The average time for each 'Plymouth' was 4 minutes, day and night, for 22 days, including all break-downs of concrete machinery.

"We placed, using one 'Plymouth' half the

time and two others half, 9810 cubic yards in 269 hours, including all delays.

"In 12 hours, on 1600-foot run, 513 cubic yards with two 'Plymouths,' 475 cubic yards in 12 hours.

"On a long run, 355 cubic yards in 8 hours with two 'Plymouths.'"

The "Plymouth"

Gasoline Locomotives

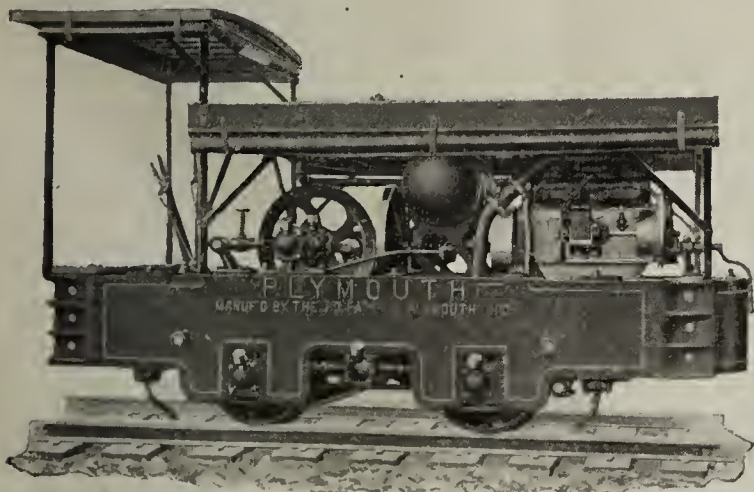
Made These Feats Possible, and Besides, Saved \$44 in Haulage Cost Every 8 Hours

The Ohio River Contract Co. not only gives the "Plymouths" ALL the credit for these records, but says that each "Plymouth" saved it \$22 on each 8-hour shift in actual cost, comparing each locomotive with SIX MULES which they replaced.

Here's How "The Plymouths" Did It

There are three BIG reasons why the "Plymouths" could speed up this work as they did and at the same time reduce the cost to such an extent—Plymouth FRICTION Drive, Plymouth LOW FUEL Consumption, and Plymouth LOW LABOR Cost—

And here's why these Plymouth features are superior to all other locomotives—no matter what power:

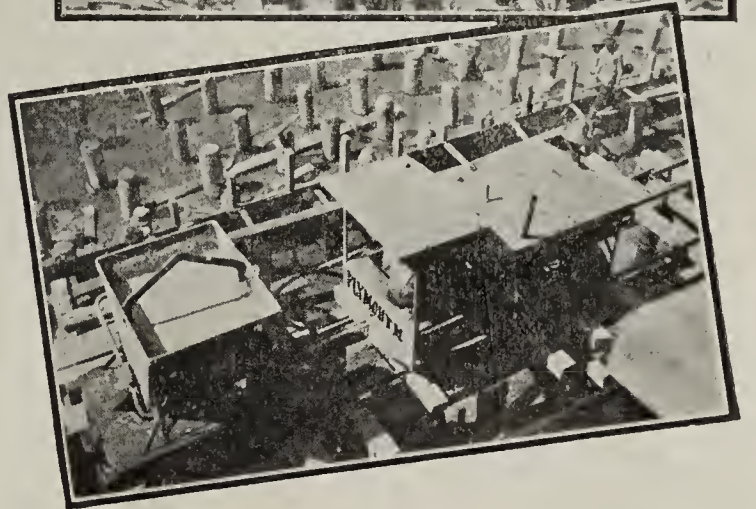


1 Plymouth Friction Drive has variable speeds and picks up load quicker than any other power.

2 Plymouth Fuel Consumption averages only FIVE gallons of gasoline per day.

3 Plymouth Labor calls for only one unskilled man at minimum wage, no engineer necessary.

THE J. D. FATE COMPANY
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It is interesting to every contractor and every manufacturer who has a haulage problem and we believe we have enough for all that ask for it, but do not take a chance—Send TO-DAY.

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(State).....

MORTAR MIXERS

The Lansing Advance Mortar Mixer, shown on this page, is not a concrete mixer made over, but designed and built as a mortar mixing machine—one reason why it does its work well.

Saves time and lime. The Lansing Advance with one or two men will do the work of six or eight men with hose—and do it much better. Economical for 5 or 6 masons or for 60.

With about one-third less lime, the mortar is richer



"Advance Mortar" Mixer.

and stronger than can be mixed by hand. Every lot is absolutely uniform, smooth and easy to work. Each mason will lay 200 to 400 more brick a day when you mix the mortar by the Lansing Advance.

Nearly all the largest buildings in recent years have been put up with mortar mixed by the Lansing Advance. This machine is built right. Simple, trouble-proof construction; ample power.

Willard Myers, contractor, 2000 East Cambria street, Philadelphia, has a Lansing Advance mortar mixer and writes as follows: "It makes perfect mortar. It is the best mixer of mortars I have ever seen or used."

Write the Lansing Company, Lansing, Mich., for a copy of their catalog 354-M, and mention CEMENT AND ENGINEERING NEWS when writing.

WATER PURIFICATION FOR ALL PURPOSES

The William B. Scaife & Sons Company of Pittsburgh have sent us a copy of their new catalog, "Water Purification for All Purposes," which illustrates the various types of water softening and purifying apparatus which they manufacture, and discusses water purification as applied to various industrial uses.

In it is included analyses from various water supplies throughout the United States and miscellaneous data for calculating water requirements for various uses. The book contains a large number of illustrations showing installations of water purifying equipment.

A copy of this catalog will be mailed to anyone requesting it.

SPECIAL CEMENT FINISHING TOOLS

A concern which has made a special study of finishing tools for concrete work is the Abram Cement Tool Company, McNair Bldg., Detroit, Mich.

A specialty is made of long-handled tools for sidewalk work. Those who are interested in this kind of work should send for a catalogue, which shows a number of combinations at different prices, the combinations being so regulated in variety and price as to fit the needs of contractors doing various kinds and amounts of work.

GET THIS FREE

It should be generally known that the Sandusky Cement Company publishes an attractive little house organ called The Medusa Review, as it is a publication which should be in the hands of all builders and products manufacturers who are using waterproofing or white cement. The November issue is a particularly attractive one.

This booklet contains valuable practical information for architects, engineers, contractors, dealers, etc. It will be sent regularly without charge by the Sandusky Cement Company, Cleveland, Ohio, to anyone who is interested in white cement or waterproofing.

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F. M. WAKEFIELD, Manager



Chicago Church Built with Faced Concrete Blocks

There is no distinctive American architecture. The wide range of climate, scenery and ideals has made an American type impossible. We face, however, in the movement for fireproof and permanent construction the necessity of designing structures which shall be lasting monuments, not only to the efforts toward permanence but toward the artistic ability of their authors. Perhaps this combination will produce an American note in art.

The great bulk of construction has its cost limitations, which has brought about the use of many surface materials which are imitative of natural stones. The more nearly these approach the colors and textures of the natural materials the more attractive they become. There is needed a practical system of building which shall combine freedom from fire danger, permanence and beauty of natural stones. It must offer a wide range of color and texture, must be impervious to weather and free from disintegration by frost. If these qualities can be obtained at reasonable cost it will have a very broad application.

The concrete block meets these specifications if it is made with a sufficiently wet mixture, is well tamped, is cured under moist conditions and if in addition it is possible within practical cost limitations to give a facing of natural stones held in a matrix of cement mortar.

The Normal Park M. E. Church, Chicago, designed by H. B. Wheelock, is an example of construction in

materials of comparatively low cost, yet with the effect of the most expensive of all natural stones—granite. It represents a departure from the common standards of church architecture, embodying the essentials of simple Gothic, but leaning toward the German Moderne school of design. The original design contemplated the use of cut stone and brick, black predominating in the foundations, a less pronounced black in the walls and panels and considerable light trim in windows and pilasters. This resulted in strong color contrasts upon which the beauty of the design largely depended. It was found, however, that the execution in stone was beyond the possible limits of cost, and bids were obtained on a structure of brick. A church of identical design using the latter material was actually built in Evanston, Ill., but the architect desired a more perfect duplication of his color scheme for the Normal Park structure.

Concrete block was investigated and a bid obtained from a reliable contractor, contemplating the use of Hydro-Stone made on a machine marketed by Hydro-Stone Co., 259 Insurance Exchange Building, Chicago. The advantages of Hydro-Stone are that the blocks are made with a very wet concrete, surfaced with a ¼-inch layer of a suitable aggregate, subjected to a pressure of over 150,000 pounds on the face and washed with water and a fiber brush when sufficiently set to permit removing the film of cement without losing the coarser particles of aggregate.

Sample blocks were made up to show how closely the original design in granite might be followed and a bid was obtained which showed a saving of 10% over the cost in brick and approximately \$6,000 over the cost in stone and brick.

Concrete was chosen and the resulting structure is full evidence of the possibility of approximating granite effects in concrete and of the excellent weathering qualities of the material.

Many shapes were required, but readily built on the one machine. The bowed transept called for circular faced blocks, having a radius of about 35 feet. The pilasters have pitched faces. The concrete stone trim used in the windows was cast with the same surface mixtures, washed to obtain the same textures but made in wood molds and hand tamped.

The use of concrete made it possible to cast units considerably larger than are common with stone. The



Entrance to the Normal Park M. E. Church, Chicago.

main entrance arch is of four pieces reinforced against cracking and the arched window above the main entrance is composed of three sections, two half arches and a key. It was possible to make a single casting having two facing mixtures; the dark panel being recessed about an inch. The central window at the back of the auditorium is of a considerable number of pieces but the same method of construction was followed.

The use of cast stone trim is already common practice, requiring careful stonecutter's details from which the form-maker shall work but otherwise no greater care than is necessary in good block construction.

The finished church is excellent in color and texture. The dark foundation course gives a feeling of stability, the walls above are somewhat lighter and are sufficiently relieved by the comparatively large amount of light colored trim to soften the harshness otherwise to be expected from large areas of black. The variation of color from block to block accentuates the unit construction of the wall and prevents the monotony of unbroken areas.

The faced concrete block is a logical material. The most easily handled building unit is approximately the size of a concrete block and considerably smaller than the common sizes of cut stone. This justifies its size. It would be possible to build a concrete block having

granite or other expensive aggregate throughout but this is an unnecessary cost and the use of this aggregate as a veneer, if structural stability and beauty are not sacrificed, is a justifiable economy. It must be said that a great proportion of the concrete block structures are not pleasing but a few notable examples, such as this church, indicate what may be expected from a careful contractor with proper equipment.

Numerous other structures of Hydro-Stone have been shown in previous issues of Cement and Engineering News: the Minnesota Steel Company's building at Duluth, the Elgin, Joliet and Eastern Railway Company's locomotive shops at Joliet, Ill., the residence belonging to E. E. Old, at Evanston, Ill., and the new Northwestern Military Academy, at Lake Geneva, Wis.

Those desiring to study the possibilities of concrete surfaces, particularly those applicable to concrete blocks, are urged to inspect the exhibits of the Hydro-Stone Company, at the Chicago Cement Show and at room 259 Insurance Exchange Building, Chicago. Various unfaced blocks are shown for factory and warehouse work; others have a facing of red and black granites, white, red and yellow marbles and mica feldspars.

These are applicable to practically every type of architecture and are as readily constructed as were the blocks for the church illustrated in this article. They are shown in order to permit a careful investigation on the part both of architect and contractor and thereby broaden the field of this product.

The manufacture of Hydro-Stone hollow wall construction for all types of building is a manufacturing business that will pay big dividends on a small investment. Hydro-Stone is a concrete building unit manufactured on low-cost equipment, under laboratory conditions easily obtained in any concrete products plant. The equipment and the methods of manufacture are under the supervision of Hydro-Stone Company, 259 Insurance Exchange Building, Chicago. The manufacture of Hydro-Stone requires common sense, intelligence and an honest desire to produce a superior building material. It is a proposition that should interest men of capital who want to establish a business which will be without competition. Hydro-Stone is demanded by architects and owners. It gets a good price and is sold on a quality basis only.

If you are interested get in touch with Hydro-Stone Company today and let them help you get started.

They won't sell Hydro-Stone equipment unless they can get right behind your local plant and see that you get started right and make money. Every Hydro-Stone plant must be a living recommendation for their business. They establish but one Hydro-Stone plant in a district.



Strong Contrasts Obtainable with Concrete Blocks.



The concrete block and stucco garage shown here is twenty by twenty feet, erected by the Goggin Const. Co., Arcola, Ill., for J. H. Sullivan. Medusa Waterproofed Cement was used in its construction. The Goggin company operate Ideal Concrete Block Machines.

Concrete Tanks for Oil

In Oklahoma they are using concrete tanks to store crude petroleum. The general custom hitherto has been to construct the tanks of steel. Insurance companies looked with disfavor upon them because of their tendency to attract lightning, but the change to concrete began only after the price of steel had risen to an almost prohibitive figure. Now it is probable concrete will remain the popular material for tanks. It has many advantages. It makes the building of much larger tanks feasible, and in one instance it is proposed to construct an immense concrete receptacle, hundreds of feet long, and divided into compartments for individual use. The tank will be owned by the community.

Jaeger Concrete Mixer for 1917

Within the covers of an attractively printed catalog of thirty-six pages, profusely illustrated with well-executed halftone engravings, are set forth the merits of the 1917, new designed concrete mixers made by the Jaeger Machine Company, 212 West Rich Street, Columbus, Ohio. The company states that a close study of the field of demand showed that what the trade really wanted was a dependable mixer that would handle an ordinary size batch and at the same time give a reasonable daily output at a saving of time and labor. The result of this investigation is the "Big-an-Little" mixer, which has proven very popular with building

contractors on all kinds of work. The claim is made that it fills all the requirements of the user and is giving great satisfaction. So great was the demand for this type that the company decided to reproduce the "Big-an-Little" in a larger size, known as the Jaeger Big Mixer. The catalog under review illustrates and describes the latest models of these mixers, and a copy of it will be sent to any interested reader of this paper who may make application for it.

State Highways

A. N. Johnson, consulting highway engineer of the Portland Cement Association, Conway Bldg., Chicago, has just been appointed to serve on a committee of the American Association of State Highway Officials, the duty of this committee being to collect from various state highway departments information as to changes which the states expect to make in their highway laws. Many states are at present planning revision or amendment of such laws so that they may take advantage of government aid in road improvement.

Concrete Roads

Outagamie county, Wis., has been advertising for bids on approximately 45 miles of concrete roads. This work will be a continuation of that commenced under a \$700,000 bond issue voted last year. A number of counties in Wisconsin are actively fostering bond issues at the present time for road improvement.



The concrete porch shown here was built by Henry Monat of Galion, Ohio, for Chas. Switzer. Mr. Monat uses Medusa Waterproofed Cement in all his porch work as it will not discolor after rains. He also operates Ideal Concrete Block Machines.

CEMENT AND ENGINEERING NEWS

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Advertising copy or changes in ads. must be in this office by the 25th of each month, as hereafter our magazine will appear on the 5th of the following month

Advertising Rates Sent on Application

JOHN F. WALDRON

Advertising Manager

CHICAGO, FEBRUARY, 1917

Concrete Pipe Association

Successful Field Meeting

The American Concrete Pipe Association held a most successful field meeting at Waterloo, Iowa, on November 9. In fact, it was so successful that it will no doubt prove a forerunner of many other such gatherings.

No formal convention sessions were planned for, the day being spent out in the field, discussing practical problems informally. The forenoon was devoted to inspection of the plants of the Cement Tile Machinery Company and the Cement Products Company. The former of these is manufacturing tile and sewer pipe machines, while the latter company is manufacturing pipe and tile. It is making the pipe which is being used on the extensive drainage work, which was visited by the party in the afternoon, known as District No. 5 of Blackhawk county. This includes 8,800 feet of 24-inch pipe, 2,200 feet of 22-inch pipe and other smaller sizes, making a total of over 50,000 feet in all, and draining about 1,800 acres of land.

The work is being done by the Anderson-Empire Company of Marshalltown, Iowa, and the pipe are being laid by means of a Sargent ditcher.

The members took luncheon together at the Russell-Lamson Hotel at noon, and in the evening they were guests of the Cement Tile Machinery Company at a dinner in the same place. The same company also took the party to one of the local theaters in the evening.

Cement Production for 1916

According to figures furnished by the Portland Cement Association the cement production for 1916 was 91,333,000 barrels, while shipments were 94,522,000 barrels. These figures are based on actual returns from 105 plants and on estimates for some other plants which do not report. It is interesting to compare these figures with those recently sent out by the United States Geological Survey, which give a production of 91,194,000 barrels and shipments of 94,508,000 barrels. Although the production during 1916 is slightly below the previous high record of 1913, the shipments for the past year hold the record.

Hydrated Lime Production
in 1916

Hydrated lime in 1916 showed striking increase, the marketed production amounting to 710,000 tons, a gain of more than 13 per cent. All states in which the production amounted to 5,000 tons or more showed increase. These states included Michigan, Illinois and Washington, in which the total production of lime decreased.

Prices of lime were generally higher in 1916 than in 1915, although in some places the increase was not great until the close of the year. Companies giving more specific information reported an increase in price of 8 to 20 per cent, or 25 to 60 cents a ton, over the average prices in their respective states in 1915. Business conditions were reported to be improved by a majority of companies and were called abnormally good by a few; but in some states the increased demand for lime was largely offset by increased cost of production and by shortage of labor, fuel, and cars. The condition of the lime industry in different sections of the country is summarized in the following paragraphs:

In the New England States the estimated total production of lime in 1916 was 418,000 tons, an increase of 5 per cent over the production in 1915. The output of hydrated lime amounted to 27,000 tons, an increase of 20 per cent. There was a general improvement in price and demand, and some companies received more orders than they could fill. Some companies reported labor troubles, increased cost of production, and some reported shortage of fuel and cars.

Estimated Hydrated Lime Production of Leading
States in 1916.

State	Tons	Hydrated Lime Per cent of gain
Pennsylvania	113,000	45
Ohio	339,000	8
Virginia	(a)	89
West Virginia	51,500	37
Wisconsin	(a)	20
Missouri	34,971	66
Maryland	31,500	65
Maine	(a)	34
Massachusetts	(a)	10
New York	7,000	190
Indiana	24,600	39
Tennessee	(a)	50

(a) Figures not disclosed, as less than 3 companies produced hydrated lime.

Freight Rates on Gravel

Notification yesterday was received by Traffic Commissioner H. D. Driscoll of the Chamber of Commerce, from the interstate commerce commission, to the effect that rates on shipments of gravel from Waco as proposed by the Missouri, Kansas and Texas Railroad had been suspended until April 29.

It had been proposed by the M. K. & Texas Ry. to raise the rate on gravel fifteen cents a ton, according to Commissioner Driscoll, on the basis that the gravel was handled on a two-line haul, the railroad having designated the Potts-Moore and the Edwardson pits as stations, thus placing the two concerns on a basis where their profits were impaired, it was claimed, to an extent which was not justified. The matter will come up for a hearing and adjudication in April.

Traffic Commissioner Driscoll worked on the case to get a stay on the effective date of the raise in rates and succeeded.—[Waco (Texas) News.]

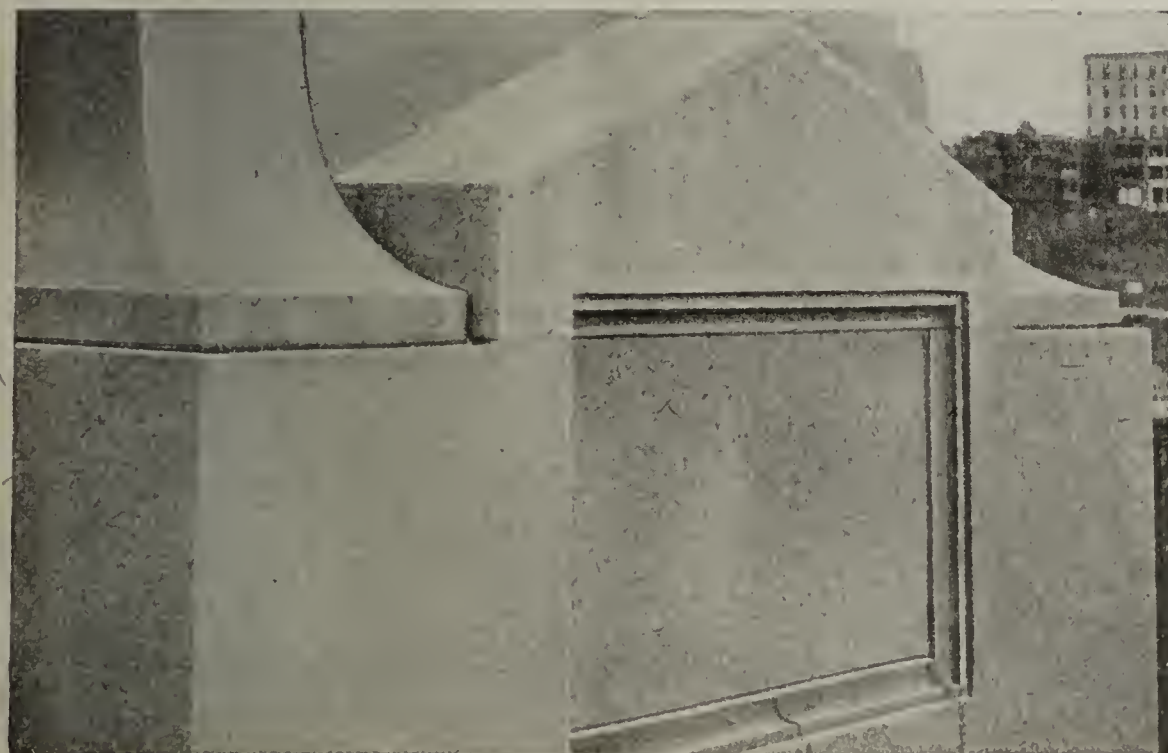


Bush-Hammered Surface.

Connecticut Avenue Bridge,
Washington, D. C.



Detail of bridge above.



Detail of Finish of Bridge Above.

Concrete surfaces may be finished by tooling by any of the methods and in any of the styles employed for dressing or finishing natural stone. Where the surface is to be tooled the best results are obtained when a facing material with comparatively small sized aggregate is used, as it is hard to dress and to obtain uniform results on surfaces where large angular hard stone is encountered. It is not necessary to construct the forms so they may be taken down in sections as was described for brushed surfaces, for the concrete should as a rule be thoroughly hardened before tooling, especially if sharp edges and surfaces of a fine uniform texture are desired.

If the forms are removed when the concrete is two or three days old and the surface is dressed with a hand pick or stone ax, a comparatively large amount of material is scaled off, the finished surface being of a coarse texture similar in appearance to rough dressed natural stone. Some variation in the appearance of the finished surface can be obtained by the manner in which the tool is handled. By striking a perpendicular blow no lines or marks are left in the surface, whereas with a glancing blow, tooth marks are left which can be made parallel to each other or at various angles.

A very desirable finish has been obtained on numerous bridges, buildings and other structures where suitable facing material has been used, by bush hammering the surface, either by hand or with a pneumatic tool. The best results with the bush hammer are obtained on thoroughly hard concrete surfaces. Where a finish of a comparatively smooth uniform texture is desired, especially on surfaces where no facing material or one composed of large aggregate has been used, the concrete should be at least two months old before bush hammering. Otherwise the particles of coarse aggregate are apt to be dislodged instead of cut and exposed, resulting in a pitted instead of a smooth

uniform surface. Nine-pound hammers having as many as 36 points on a cutting face four inches square have been used, but the most satisfactory results are apparently obtained with lighter hammers having fewer points. In one case a better finish was obtained and at a less cost by substituting a hammer having 16 points for one having 36 points, and a popular hammer for finishing concrete surfaces is one weighing about three pounds and having but 4 points.

The exposed surfaces of the concrete stone used in the construction of the Connecticut Avenue Bridge,

Washington, D. C., shown herewith, were faced with a 1:3 mixture of Portland cement and $\frac{3}{8}$ -inch crushed granite screenings and finished by bush hammering. The work was done by hand using patented hammers and skilled labor, and a very good finish closely resembling dressed granite was obtained. The cover of this booklet shows one of the four concrete lions on the approach to the bridge. The concrete pedestal supporting the lion, shown in greater detail herewith has a bush hammered surface and the finish obtained here is representative of that of the entire structure.

Sand Blasted Surfaces

A finish of very much the same texture and appearance as that obtained by brushing while green may be obtained by sand blasting a thoroughly hardened concrete surface. Any pronounced ridges or irregularities in surface, formed by cracks or open joints in the forms should be removed by tooling and any pointing that may be necessary should be done several days before the surface is sand blasted. In attempting to remove these ridges with the sand blast, the surface on either side is apt to be cut too deep and depressions in the surface intensified or made more prominent instead of being erased. Where it is possible to do so the strips nailed to the forms to make molding, joints and courses, should be left in place while the surface is being sand blasted. Otherwise the sharp angles and edges will be rounded off in a rough and unsightly manner. Leaving the area protected by the strips unfinished adds to, rather than detracts from the appearance of the work. When sand blasting near the intersection of two surfaces a board should be held against one in such a manner as to protect the angle or edge, as the case may be, if a clean cut line is desired.

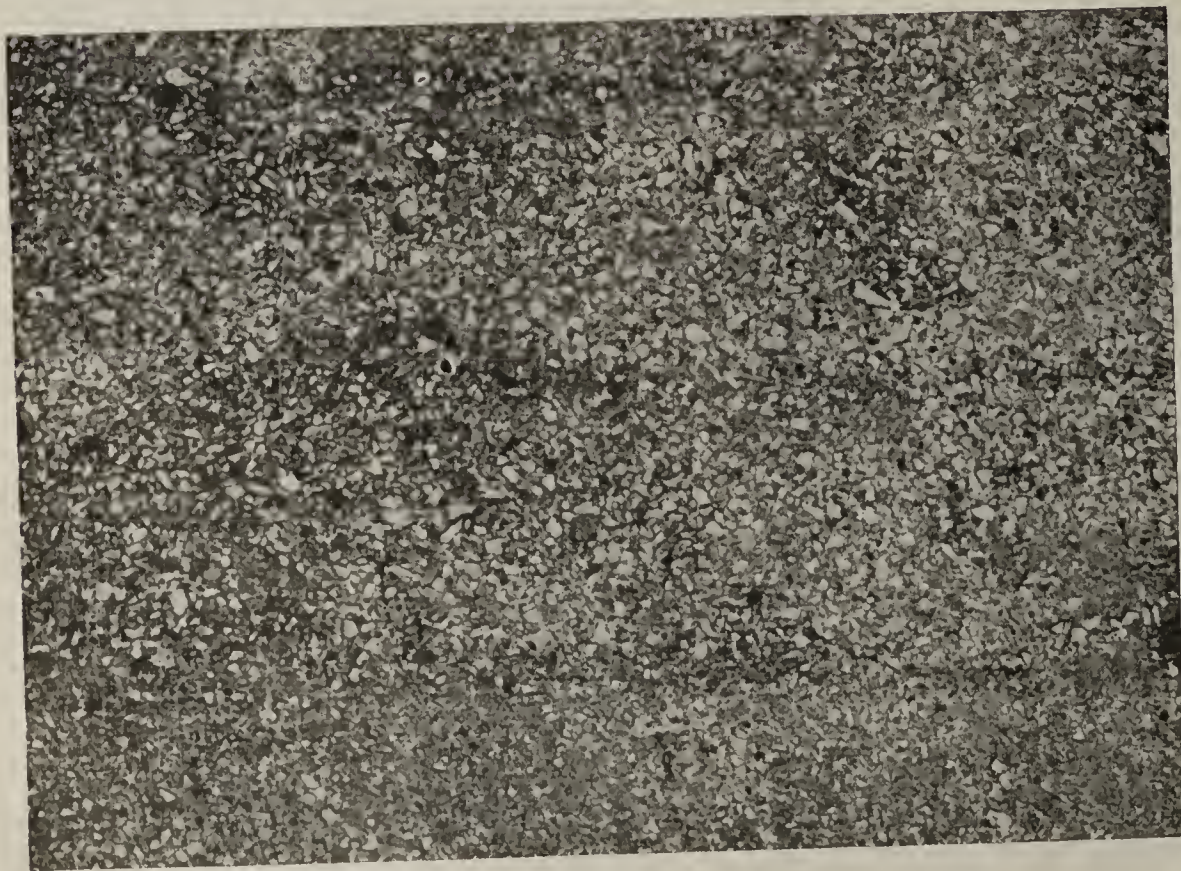
Upon a smooth, dense, thoroughly hardened concrete surface a $\frac{3}{8}$ -inch nozzle may be used, but under ordinary conditions $\frac{1}{4}$ -inch or even $\frac{1}{8}$ -inch nozzles have been found to give the best results. A clean, sharp, thoroughly dried silica, sand or crushed quartz is more effective for sand blasting, and for use with a $\frac{1}{4}$ -inch nozzle the sand should be screened through a No. 8 screen, and through a No. 12 when a $\frac{1}{8}$ -inch nozzle is used. The best results are apparently obtained on a thoroughly hardened concrete surface at least a month old, and for such work a nozzle pressure of from 50 to 80 pounds will be required.

The surface of the concrete station shown herewith was finished by sand blasting and the other cut shows in detail the character of the finish obtained.



Monolithic Concrete Station,
C., M. & St. P. Ry.,
Columbus, Wis.

Sand Blast Finish.
No Special Facing.



Detail of Finish on Station
of C., M. & St. P. Ry., Columbus, Wis.

Rubbed Concrete Surfaces

By removing the forms from the work when the concrete is a day or two old and rubbing the surface with a brick of carborundum, emery, concrete or soft natural stone, a desirable surface finish may be obtained. With this method of surface treatment the best results are obtained where a facing mixture containing little or no coarse aggregate is used, or where the coarse material has been well spaded back from the face of the work. In connection with the rubbing, a thin grout composed of cement and sand should be applied to the surface, well rubbed in, and the work afterwards washed down with clean water. The grout is used simply to fill surface imperfections and should not remain as a film on the surface.

This method of treatment erases form markings and produces a comparatively smooth surface of uniform color much superior to that obtained by the all too prevalent method of painting with a grout, which almost invariably crazes, cracks and peels off. During the past two years a large amount of concrete work has been done in Chicago and its suburbs by the Railroad Companies in connection with their track elevation and the exposed surfaces of concrete abutments and of miles of retaining walls have been given a suitable finish by this method. The present appearance of the work indicates that it makes a very acceptable cheap way of finishing work of this character. The exposed surfaces of the structures shown herewith were finished in this manner.



Retaining Wall,
C. & N. W. Ry.,
Evanston, Ill.

Rubbed Concrete Surface.
Special Mortar Facing



Monolith Concrete Station,
C. & N. W. Ry.,
Evanston, Ill.

Rubbed Concrete Surface,
Treated with Cement Stain.
Special Mortar Facing

Concrete Road Construction in Delaware

Methods of construction on the DuPont concrete highway in Delaware are described by Charles Upham, chief engineer for the highway, as follows: Expansion joints are placed only when the concrete mixer stops for as much as 15 minutes. The pavement is 14 ft. wide, 7 in. thick at the centre, and 5 in. on the sides, and placed on a flat subgrade.

Part of the pavement has been laid with and part without reinforcement. One division of the highway is reinforced for the entire width with No. 29 American Steel & Wire Co. Triangle mesh reinforcement. The weight of reinforcement per sq. yd. is 2.52 lb. Wherever the slab was less than 178 ft. long, no cracks have appeared. Another division is reinforced for the entire width with No. 25 expanded metal. The weight of reinforcement per sq. yd. was 2.25 lb. Where the slab was less than 164 ft. long, no cracks have appeared.

Other divisions were reinforced with expanded metal for a distance of 3 ft. and also of 4 ft. on each side of the centre line. More cracks appeared in these pavements than those that were reinforced for the entire width. Divisions of unreinforced pavement showed more cracks than divisions that were reinforced for the entire width, but not so many as where only part of the pavement is reinforced. This last may have been partly because the reinforced parts of the highway were laid the most recently. The increased cost due to reinforcement is 9c. per sq. yd. It should be remembered that this work is near the steel-mills, and the cost would be somewhat higher on the Pacific Coast.

Hydrated lime in varying proportions up to 10% was used on part of the highway. Sufficient time has not elapsed to draw any definite conclusions, except that the addition of the lime is beneficial in reducing the number of cracks.

Brushed Concrete Surfaces

Where the finish is to be obtained by brushing, the forms must be removed from the work as soon as possible and the concrete surface brushed while still green. It is not possible to state how old work should be before removing the forms and brushing the surface. This will depend upon a number of conditions: the character of the work, cement and aggregate used, consistency of the mixture and very much upon the weather conditions. As a rule, in hot weather the forms should be removed the next day and the surface brushed, but in cold weather the facing form cannot be removed so soon, several days or perhaps a week being required for the concrete to obtain the necessary hardness and strength. Care must be taken that the brushing is not started too soon as little particles of aggregate will be removed resulting in a pitted and unsightly surface. On the other hand, the longer the

surface stands before being brushed the more brushing it will require to remove the film of mortar that has flushed to the surface. The brushing should be started just as soon as it is possible to do so without removing particles of aggregate. The time required for sufficient hardening can only be determined by experimenting with the particular surface.

A brush about four inches wide, made by clamping together a sufficient number of sheets wire cloth, has been found to be more effective and cheaper than the ordinary wire brush for brushing green concrete surfaces. An ordinary scrubbing brush with stiff palmetto or other fibre bristles will answer if the surface is not permitted to get too hard. The free application of water during the brushing will materially assist in the work.

After the entire surface has been brushed the appearance of the work can be improved by washing



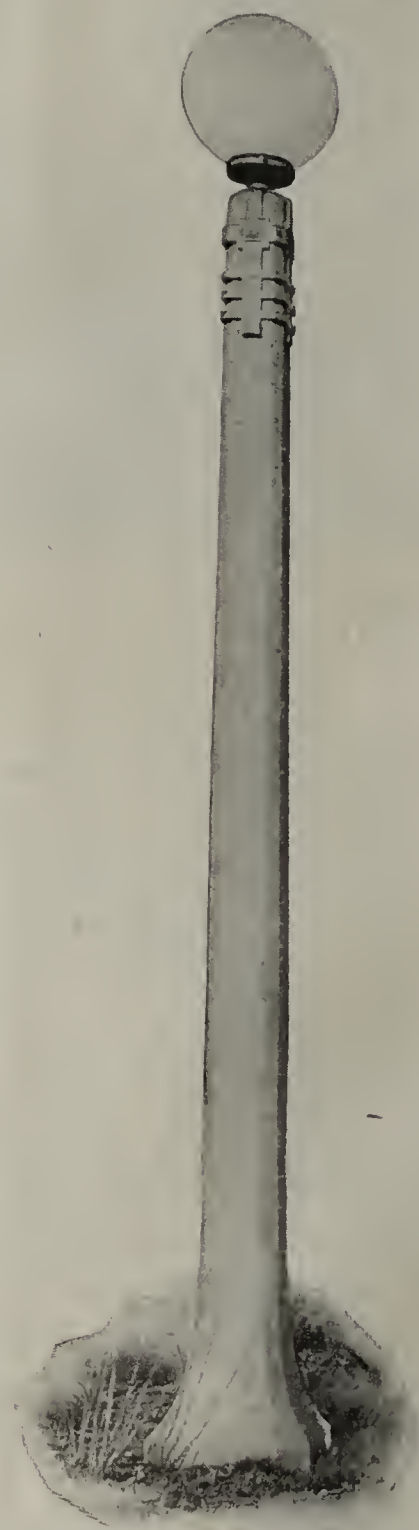
Residence,
Evanston, Ill.

Brushed Concrete Surface.
Special Facing.



Detail of Residence
Illustrated Above.

Brushed Concrete Surface.
Special Facing.



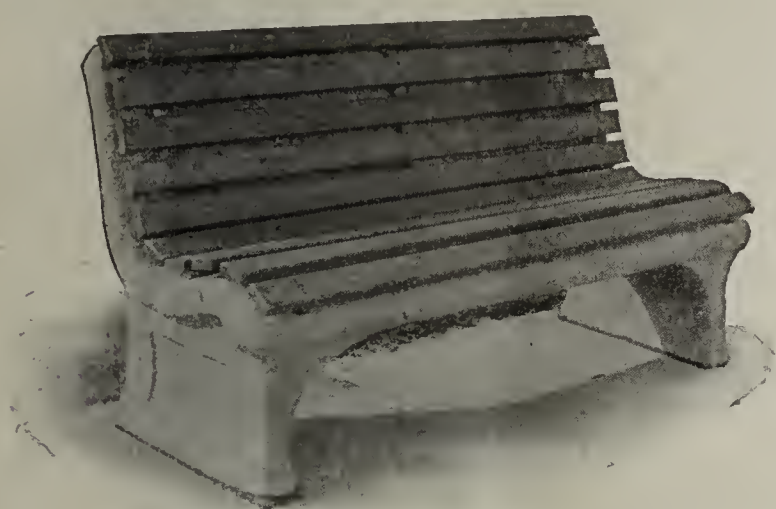
Lighting Pillar,
Lincoln Park,
Chicago.

Brushed
Concrete
Surface,
Treated
With Acid.
Special Facing.

with a diluted solution of acid applied with a brush. While wet with acid the surface should be quickly worked over with an ordinary scrubbing brush and the acid immediately removed with clear water applied through a hose. It is important that the surface be thoroughly washed after the acid treatment as otherwise it will have a mottled, streaky appearance. This final acid treatment thoroughly cleans the aggregate, thereby intensifying the color and assists greatly in giving the surface a uniform appearance, especially on large surfaces where different sections have been brushed at different times.

A solution of one part commercial muriatic acid to 2 or 3 parts of clean water should be used on surfaces in which standard Portland cement is used, and a sulphuric acid solution of the same strength when white Portland cement and white aggregates are used in the facing mixture.

A good grade of limestone makes a very acceptable white aggregate to use in place of the more expensive



Concrete Park Bench.
Lincoln Park, Chicago.

white marble, and both black granite and trap rock make good substitutes for black marble where a dark surface is desired. By varying the size of the aggregate used, a surface finish of practically any desired texture may be obtained, the size and grading of the aggregate producing nearly as much variation in this respect as its color does in the appearance of finished surfaces. Fine, well graded aggregates produce a comparatively smooth even grain surface of a solid uniform color, whereas large one-size aggregate makes a much rougher surface of not such a solid uniform color.

This method of finishing exposed concrete surfaces by brushing may be used for all types of construction. It is suitable for finishing the surface of concrete blocks and architectural stone where the forms can be removed immediately, as well as for monolithic work, such as foundations, building and bridges, where the forms must be left in place for a short time. The cuts shown herewith give some idea of the variety of actual construction where a desirable surface finish has been obtained by brushing.

Safety First in Blasting

We believe that all employers of labor try to exercise reasonable care to prevent accidents to their men. Ordinary instincts of humanity, if nothing more, would dictate such a policy.

In the state of Pennsylvania now there are additional reasons why employers should be particularly careful to avoid accidents. The new compensation law makes the adoption of safety features more imperative in that state than ever before.

We feel that a few suggestions to employers in lines of work that call for the use of explosives will be particularly apropos at this time:

1. Use low freezing extra dynamites wherever possible in preference to the high freezing straight dynamites. They are safer because they are less sensitive to accidental shocks, and seldom require thawing. In addition, they are considerably cheaper.

2. Adopt electrical blasting methods wherever possible in preference to fuse and blasting cap method. The principal object of this is to prevent hang fires and misfires which are always dangerous to workmen.

3. The use of blasting machines in blasting operations makes it unnecessary to have matches on the job. The advantage of this is obvious.

4. Every blasting operation should have a galvanometer for testing blasting circuits and a rheostat as a part of the equipment. These useful little pieces of apparatus eliminate the guessing, which is always expensive and entails risk of life.

5. When thawing is necessary, use standard thawing kettles or thawing house equipment instead of permitting employes to soak frozen dynamite in warm water, or to heat it in ovens, or to thaw it by standing it around an open fire. All of these practices are dangerous.

6. Magazines should be kept clean and dry. Sand, nails, or other foreign substances on floors may cause explosions and result in loss of life.

7. Magazines should be properly located to comply with the American table of distances.

8. Dynamite and blasting supplies should be kept separate until they are ready to be loaded into bore holes.

Compliance with the above simple suggestions may save a good many lives and render employers immune from damages under the new Pennsylvania compensation law, and what is good for Pennsylvania is good for any other state, even if it doesn't happen to have a compensation law.—Du Pont Magazine.

Farm Building Design

Charles A. Norman, formerly instructor in charge of farm structures work, Purdue University; L. H. DeMuth, formerly manager of the Cement Stave Silo Co., Sedalia, Mo., and a graduate in agriculture of the University of Missouri; and W. G. Kaiser, formerly experimentalist in farm building design, Iowa State College, have recently taken positions with the Portland Cement Association at Chicago headquarters. These men will devote their efforts to extending the activities of the Extension Division Farm Bureau of the Portland Cement Association. Mr. Kaiser will have charge of farm building design, Mr. DeMuth will devote his attention to rural contractor co-operation and general farm promotion work, while Mr. Norman will be engaged in investigational inquiry work.

New Medusa White Cement Booklet

Cement & Engineering News has been favored with an advance copy of a handsome new booklet on Medusa white portland cement, this booklet being now about ready for general distribution by the Sandusky Cement Company, Department T9, Cleveland, Ohio.

It is a book of 48 pages, handsomely illustrated and descriptive of the many uses which can be made of white cement.

Specifications and complete directions for handling this material are also included. Write for a copy.

How I Specify Stucco Work

By Henry F. Hoit

Architect, Kansas City, Mo.

Concrete plaster, or what is generally termed "stucco," offers so many possibilities to the architect, especially for suburban and country home work, that the enterprising men in the profession cannot afford to overlook it. It fits so harmoniously into a landscape made up largely of greensward, shrubbery and overhanging trees; its plasticity allows the architect to exercise his creative powers unhampered by close limitations of the material in which he is working; while it appeals to the owner not only on account of its beauty, but because of its permanence if properly put on and its freedom from any excessive annual cost to keep it in condition.

It cannot be denied, however, that many builders, eager to get seeming results with the least expenditure, or ignorant of the true nature of the materials with which they are working, have put up a large amount of stucco work which will not stand the test of time—and this test is, as I see it, one of the first things to be thought of in designing any kind of concrete work. We are compelled to see in almost every locality stucco houses with walls which crack, peel off, are caved in by accidental heavy blows, or have fallen down entirely because of the failure of the metal to hold its load of plaster.

All these things led up to a desire on my part to formulate a specification which would produce a stucco acceptable to the best class of clients, men of taste, and with means to provide handsome and permanent homes for themselves.

My starting point, I think, was a determination in my own mind that an air space back of the stucco coat is fundamentally wrong. For one thing, it is a point of weakness, giving the plaster an opportunity to break under any sudden impact, such as a tool being thrown against it, the falling of a tree branch, or the depredations of destructive children. An air space, unless the stucco is back-plastered, also offers an opportunity for corrosive influences to work destructively on the metal lath. To avoid this air space I decided on two expedients: a thinner furring than the ordinary strip, and a type of metal lath which would allow the plaster to go through it readily and adhere closely to the building paper covering the sheeting.

My furring strips are 5/16-inch steel rods, placed 8 inches on centers, and held in place with staples. Over these is placed galvanized wire cloth, held in place with galvanized staples at the furring rods. The wire cloth is made of No. 18 wire, with mesh $2\frac{1}{2}$ squares to the inch and galvanized after weaving.

By insisting on having the plaster a full inch in thickness, I thus get what is practically a 1-inch reinforced concrete wall, with the metal completely embedded in it, and with the added advantage that this wall of plaster is not standing alone, as is usually the case, but is adhering closely to the backing provided for it.

I might say, too, that I specify 2x6 inch studding on all my work, instead of 2x4 inch, as this gives more stability to the wall, with less liability of cracking of the plaster from settlement, wind pressure, and the like. I use matched sheeting, placing it on the studs diagonally, and over this I specify an extra good grade of waterproof building paper. This latter is something which is often neglected, but it should not be; the general belief seems to be that paper is paper, that a membrane of some fibrous substance is all that is necessary for the purpose, the cheaper the better. As a matter of fact, this paper has a two-fold purpose, that of insulating the house against both cold and moisture.

Any kind of paper will probably help to keep out the cold, but the thicker and more densely woven it is the better will be its insulating power. To keep out moisture, however, it must be scientifically prepared with any one of a number of weather-proofing preparations.

My stucco specifications in detail are as follows:

All lathing for stucco shall be galvanized wire cloth No. 18 wire, $2\frac{1}{2} \times 2\frac{1}{2}$ mesh, as per sample submitted to and approved by the architect, securely fastened on walls with galvanized iron staples over 5/16-inch steel rods, spaced 8 inches on centers.

On this lathing everywhere put cement 1 inch thick, three coat work, with rough cast finish, sample of which must be made to meet with the architect's approval before any work is done.

First coat shall consist of 1 part cement and 3 parts, by measure, of clean sand. To every barrel of cement used, one bucketful of lime putty may be added, which has been previously slacked and to which a large quantity of long fibre or hair has been added.

Second coat to consist of same material and proportions as the first, with the exception that the fibre or hair is omitted.

The last coat to be done with 1 part Medusa white cement and 2 parts of Carthage crushed limestone No. 112. Before mixing add 2 pounds of Medusa waterproofing compound to each sack of cement used in the finish coat, mixing same thoroughly with the dry cement before adding the crushed limestone or water. Hydrated lime may be used instead of Medusa.

Finish coat to be dashed on with a brush, and to be tinted with mineral color a light cream-white; color subject to approval of architect.

This is taken verbatim from the specifications drawn up recently for a residence for one of my clients. The provisions in regard to the materials used for the finish coat would, of course, vary according to the design of the architect and the taste of the owner.

Storage Battery Trucks

Bulletin No. 200, of the Jeffrey Manufacturing Company, contains illustrations, specifications and descriptions of various types of storage battery trucks, which are adapted for use in industrial plants, factories, warehouses, foundries, lumber yards, copper smelting plants, cotton mills, straw board works, paper mills, etc.

The illustrations in the bulletin show various types of trucks working under different conditions. The Jeffrey Manufacturing Company will gladly co-operate with prospective customers and recommend sizes and types for their particular work, and furnish them with additional information, if they will specify an outline of their requirements.

These trucks have effected large savings in time, labor and expense in plants where they have been installed, being adapted to the transferring of all classes of material about the yards of large industrial plants, and are designed to carry the load as well as to push or pull the loaded cars, no skilled labor being required for their operation or handling.

The flexibility of the track system used, gives wide range of operation and permits the truck to run over tracks and in and out of buildings or anywhere about the plant with absolute safety, as no overhead wires are required.

Either Edison or Exide types of storage batteries are regularly used, though other types may be specified by the users.

Building the Stucco-Coated House

Some Reasons Why This Form of Construction
Should Appeal to the Present-Day Home Builder

BY WARFIELD WEBB

In building the home we have many important matters to keep in mind, as there is a vast difference between a "home" and a "house." The latter is a living abode in many cases, but the former is to be the ideal, and the one place that should be so erected. The important consideration then is to make the home attractive from the outside. More people see the exterior of the home than the interior, and a good appearance should be planned out well in advance.



Cement Stucco Work, Chafman & Frazer, Architects.
Entrance to Estate at Chestnut Hill, Mass.



A Cement Stucco House at Newton, Mass.,
Chafman & Frazer, Architects.

There should be a study made of the location—the setting—the size, the style and the material for the exterior. The latter becomes vital, because upon its selection must depend the final success of the undertaking. The exterior should comprise art, durability, good taste, and be capable of making the ideal that we have set up for ourselves. Now there are many styles of exterior material. These comprise a variety of color effects, and when properly put in place bring into being the most exacting requirements of the owner.

If we build we should keep before us the nature of the building, its location, and try to make the material harmonize with the surroundings. Do we fully value the effect that this brings about and the lack of which does so much to depreciate the home from an artistic point? There should be in mind the idea of erecting a home for its beauty, and this becomes, not only to ourselves a source of gratification, but enhances the value of the structure, and magnifies its true value.

There is, however, a vast difference between the home with true art in the exterior, and one that partakes of the cumbersome type, the sought-after-effects having been stifled in the effort to create something different. The true beauty lies in simplicity, and this is easily attained where the effort is made in earnest. Simplicity in design is the most striking evidence of real merit. The insignia of beauty lies in its greater conception as applied to the home.

Today we see many homes erected with a stucco exterior. It might be added that some of these, and a goodly percentage, are lacking in the very essential for which we were originally striving—the attractive exterior. This is due to several things. In the first place the style of the house is such as to make the exterior inharmonious. The lines and angles are out of proportion and the setting lacking in important respects. The exterior itself is devoid of proper color effect, and the material, sometimes of poor quality and improperly applied, gives the structure a hideous appearance.

To make the stucco exterior home of real attractiveness, and to make it likewise durable, we cannot afford to use inferior material. The logic of this is so plain as to need no comment. Then, with good material in the hands of inferior or careless workmen, there will be a like unsatisfactory job, and the house will be to the owner what it is to the beholder—a miserable makeshift. It might be added that with the use of the best stucco the effects possible are wonderful, and with the use of the contrary kind there is nothing that will so mar its value and its outward appearance.

Some contractors, and they are not alone the guilty parties in such cases, resort to inferior material, with the addition of inferior workmanship, and in this way make the home anything but attractive and a just cause for complaint. To make stucco durable, attractive and combine with these attributes the effects that are sought by the home builder, the best material only should be applied to the walls. In no case should lime become a part of the stucco, as lime kills the life of the material, as well as its appearance.

It is an erroneous idea that some home builders have that stucco can only be made in the natural cement color, or confined to gray, of several shades, or white. The inferior grades, it must be admitted, are confined to a limited number of colors, and even then to such shades as will not long retain their original hue. Instances of this are common, and further there are to be seen vast cracks, even loose sections and sometimes large sections falling off.

Good Materials Should Be Used

These defects are laid to the foundation, or to the lath, by the man who has applied the stucco many times, and he seeks to hide his own inferior material or lack of conscientious labor. Good stucco, that which contains no lime at all, only a combination of

Portland cement stucco is used, however, wood lath, when properly applied, will give entire satisfaction to the owner. One thing should be kept well in mind, and this is the security of the roof. If there are any weaknesses in this way, there will be some serious danger of the best stucco being damaged. The base, water tables, sills, door and window frames should be set with care and the other exterior sections of the house in no essential part slighted. The results of this carelessness will act as a loophole and will permit the stucco to show greater or less damage.

Three Coats Should Be Applied

When properly applied stucco should be put on in three distinct coats. The first, or scratch coat, with as much care as the second and final or "dash coat." The second coat serves as a greater foundation and as a surface for the outer finish. This third coat can be either of "rough cast" or "float," according to the nature of the application, one being less uneven in texture than the other. There should be ample time allowed between the application of the several surfaces to permit them to dry out, and become hardened before applying the successive coat.

To make the color effects possible one has to purchase only the best Portland cement stucco, the color being already mixed in, and only needing the addition of water to make it workable. Sometimes marble, Medusa white cement, granite, or quartz chips or gravel are used to make a more attractive exterior possible. Some of these, when mixed and applied with intelligence, permit of an acid washing, that brings out most wonderful effects and distinguishes the house for its signal beauty.

Good stucco can be applied to wood, metal, brick or tile surface. In the remodeling of homes it has been found an ideal material. It is so easily applied and the cost so low, comparatively, that it has become one of the very popular materials for home building. It is durable, lasting for years intact, and is accepted by the insurance fire underwriters as a fire resisting material even when applied to frame houses.

Building for Durability

It might be considered, at least by some, to be an inferior and cheap house material. Today there are a large number of residences coated with the best quality of stucco. The inferior kind is only found on the cheap house. The man who builds the more costly home is insistent upon having only the best, and this costs so little more than the less desirable kind as to be only a trifling reason why it should not be adopted by the home builder. He is not building for a day or a month, but for years, and he should have not only an attractive exterior, but one that will serve him for years and always be to him a source of comfort.



Cement Stucco Work,
A Patio in House at Marriion, Mass.

Chafman & Frazer, Architects.

Portland cement, pure sand or silica and crushed stone, marble, quartz, granite, or whatever aggregate may be used as the finish, when placed upon a foundation of either wood or metal lath or other durable surface will insure the very best possible results to the home builder. It will do more—it will be possible with a material of this kind to make the color effects, not only of many hues, but to harmonize with any desired effect.

The Color Scheme

The colors are of the most delicate hues, and the shades will last as long as the house itself. But there must be care exercised in the building of the home to bring about this result. The entire structure must be built with honesty and good materials should be used in all important sections. If the foundation is weak in any part, we must expect the best quality of stucco to show cracks when the house settles. Even brick and stone will crack under such strains. The fault in this case is due to inferior workmanship.

The lath should preferably be metal, as it has proven its greater service for such work. Where the best

A recent report made by E. R. Conant, Chief Engineer of the City of Savannah, Ga., relative to the methods and cost of street cleaning in that city shows another economy of concrete. Mr. Conant reports that the concrete pavement in Savannah costs \$22 per thousand square yards per year to clean. In other words, it is the cheapest type from this standpoint which is used in Savannah.

Aggregates for Concrete Roads, Part 2

Conclusions of Report of Committee IV, National Conference on Concrete Road Building

CHAIRMAN D. A. ABRAMS

Professor in Charge, Structural Materials Research Laboratory, Lewis Institute, Chicago

Washing a given weight of sand in a glass percolator with running water under a constant head until the wash water becomes clear, and determining the amount of silt on the basis of the loss of weight, seems to be the most accurate and scientific method for laboratory use. For a discussion of another method, see Appendix A, on "Field Inspection of Aggregates." A chemical analysis of the silt frequently indicates the presence of injurious materials. The strength test of mortars and concretes generally furnishes a safe criterion of the effect of such impurities as are contained in the silt.

Miscellaneous Tests—The exact bearing of the chemical and mineralogical composition of an aggregate on its suitability for use in concrete roads has not been definitely established. In so far as variation in these properties affects the toughness, resistance to weather, wear, etc., they will influence the final value of the material. The form of fracture, and the nature of the surface of the articles, have an important bearing on the road-making quality of aggregates.

Tests of Mortars and Concretes

A discussion of the properties of concrete aggregates must of necessity deal largely with tests of mortars and concretes. A wear test of concrete, standardized with reference to the behavior of concrete in service would furnish the most direct indication of the value of different aggregates for concrete road construction. Such a test would be of assistance in studying the effect of other variables such as the proportioning, mixing, and seasoning of the concrete.

A suitable strength test of a mortar or concrete made up from cement and the aggregates in question is without doubt the most reliable single determination which can be made in view of our present knowledge. This test gives information as to whether or not the aggregate affects the setting and hardening of the cement—a consideration of prime importance. It also indicates what may be expected from the standpoint of strength. If the form of test specimen, proportions, method of mixing, seasoning, etc., are standardized or are made to approximate those used in the work, an excellent indication can be secured of the probable strength of the concrete in the structure. It is apparent that tests of concrete furnish the best criterion of the concrete-making quality of either a fine or a coarse aggregate.

Experience in the selection of materials for concrete roads has indicated the importance of strength tests, particularly of fine aggregates. For strength tests of fine aggregates a 1:3 mortar mix has become standard, largely for the reason that differences in the mortar-making quality of the aggregate are emphasized by a comparatively lean mix. The standard tension briquet has been generally used for such tests. Recent experiences in the testing of aggregates have suggested that the briquet test of mortars may be of questionable value as a criterion of the concrete-making quality of any material. This has led to inquiry as to whether compression tests of sand mortars or concretes in which the aggregates in question are used may not be a safer guide.

It should always be recognized that mortar strength tests of fine aggregates are purely comparative. The actual values obtained in the test will depend largely

on factors which cannot be covered by specification requirements, such as the properties of the cement used and minor differences in manipulation. Comparison of mortar strength with that of standard sand mortars seems to give satisfactory results.

In the "Proposed Specification for Concrete Aggregates," which accompanies this report, no mention is made of the form of specimen to be used. The proposed test for fine aggregates gives a direct comparison with standard sand mortar. The only requirements are that a 1:3 mix shall be used, that the plasticity of the mortar be similar, that the parallel sets of specimens be made by the same operator using the same cement, and that they be made, stored, and tested in the same manner. This leaves the form of specimen optional. It is suggested that compression tests be made on 2 by 4-inch or 3 by 6-inch mortar cylinders, until a standard procedure for compression tests is agreed upon.

There is great need for a standard compression test for concrete which will enable comparisons of coarse aggregates to be made. Studies have already been directed toward the selection of a graded gravel or a crushed stone which may be used as a "standard coarse aggregate." Such a material would then bear the same relation to strength tests of concrete made of different coarse aggregates that standard Ottawa sand now bears to tests of mortars from fine aggregate.

Aggregate Materials

Information furnished by the Association of American Portland Cement Manufacturers indicates that the coarse aggregates used in concrete roads built in the United States to date may be classified as follows: crushed rock, all kinds, 55 per cent; gravel, 40 per cent; miscellaneous materials, 5 per cent. Natural sands account for nearly all the fine aggregate.

Granites and trap rocks, quartzite, conglomerates, hard limestones, sound, clean sands and gravels, close-grained sandstones and dense blast furnace slag of proper chemical composition are excellent aggregates for concrete roads; soft limestones, inferior sands and gravels, and other questionable materials should not be used in concrete roads.

It has not been considered feasible to present data on the distribution, methods of production and cost of concrete aggregates.

Aggregate Specifications

Specifications for aggregates for concrete road building should be based upon definite requirements which are defined by tests of such an exact nature that only high-grade materials will be admitted. The ideal specification would define certain qualities by which all materials could be measured. This would probably imply carrying out a wear test of the finished concrete. Our present knowledge of the effect of variations in the materials used and the methods employed in making and handling concrete do not enable us to do this. The tendency has recently been in the opposite direction; namely, to fix different specification requirements for each class and size of aggregate material.

In the absence of information upon which to base a general specification, certain requirements for grading,

cleanness, and mortar strength are found serviceable. The proposed specification for aggregates presented is based on the requirements of fine and coarse aggregates for one-course concrete road construction. A change in the maximum size of the coarse aggregate will be necessary to adapt the specification to the requirements for the top course of a two-course road. In the base of a two-course road, materials of a somewhat lower quality may be used, if it is economical to do so.

Some phases of the specification requirements for aggregate were discussed under "Aggregate Tests." The fine aggregates specification is directed with particular reference to natural sands.* The form of specimen to be used is left optional for the reason that both tension and compression tests are in use. The present trend of practice seems to be in favor of a compression test. The sliding scale of ratios between the strength of concrete sand and standard Ottawa sand mortars is based on the desirability of placing a premium on the results of the older tests.

Proposed Specifications for Aggregates for One-Course Concrete Roads

Aggregates—All aggregates used shall conform to the requirements of these specifications. Before delivery of material at the site of the work the contractor shall submit to the engineer a sample weighing not less than fifty (50) pounds of each of the fine and coarse aggregates proposed for use. The engineer shall determine, by means of tests, whether said samples comply with the requirements of these specifications. The acceptance of samples shall not be construed as a guarantee of acceptance of other lots of material from the same source. The engineer may make tests on all lots of aggregate delivered on the work in order to determine whether specification requirements are met.

Fine Aggregate—Fine aggregate shall consist of natural sand or screenings from hard, tough, durable crushed rock or gravel consisting of quartzite grains or other equally hard material graded from coarse to fine with the coarse particles predominating.

Fine aggregate, when dry, shall pass a sieve having four (4) meshes per linear inch; not more than ninety (90) nor less than fifty (50) per cent shall be finer than a sieve having eight (8) meshes per linear inch. Not more than twenty (20) per cent shall be finer than a sieve having fifty† (50) meshes per linear inch, and not more than five (5) per cent shall be finer than a sieve having one hundred (100) meshes per linear inch. The above-mentioned percentages shall be computed on the basis of weight. Fine aggregate shall contain no vegetable or other deleterious materials, and not more than three (3) per cent of clay or loam, by weight.

Fine aggregates which give a mortar strength equal to or higher than the minimum value at any of the ages named below, shall be considered as fulfilling the mortar strength requirements of this specification.

Age at Test	Minimum Strength of 1:3
	Fine Aggregate Mortar
72 hours	1.25 times (A)
7 days	1.10 times (A)
28 days	1.00 times (A)

(A) equals the strength of 1:3 standard Ottawa sand mortar specimens of same form and size, of similar plasticity, made by the same operator using the same cement.

*Mr. Mattimore voted "no" on the inclusion of screenings under the specification for fine aggregates; and "no" on the value of 1.10 for the ratio of the strength of fine aggregate mortars to standard Ottawa sand mortar at the age of 7 days.

†The No. 48 sieve has openings of the same size as the usual No. 50 sieves.

The tests shall be made on mortars composed of one (1) part Portland cement and three (3) parts, by weight, of fine aggregate or standard Ottawa sand. The test specimens shall be made, stored, and tested in the same manner. All mortar strength shall be made under laboratory conditions in accordance with recognized standards. Each value shall be the average from tests of not fewer than three (3) specimens.

Coarse Aggregate—Coarse aggregate shall consist of clean, hard, tough, and durable crushed rock or gravel. Coarse aggregate shall contain no vegetable or other deleterious matter, and shall be free from soft, flat, or elongated particles.

Coarse aggregate shall be graded from two (2) inches down. The coarsest particles shall pass a two (2)-inch round opening. Not more than five (5) per cent, by weight, shall be finer than a sieve having four (4) meshes per linear inch.

Ready-Mixed Aggregates—Run-of-crusher stone, run-of-bank gravel, or other read-prepared mixes of fine and coarse aggregates, shall not be used.

APPENDIX

Field Inspection of Concrete Aggregates

Field inspection of concrete aggregates is understood to include visual inspection and all determinations which can be made by means of the physical senses and such apparatus as may be found ready at hand or conveniently carried about. It is recognized that the value of field inspection depends entirely upon the experience and training of the individual making such inspection. It is usually assumed that field tests are of such a simple character and of such an approximate nature that they can be carried out and properly interpreted by men of little or no experience in the use and testing of such materials.

The field tests which may be applied to advantage depend upon the nature, location, and previous treatment of the material. A careful examination of the surroundings from which a material comes and an inspection of the operation of the plant producing it frequently furnish valuable guides.

Field tests are frequently relied upon to give information as to the probable durability of a material, its cleanness, and grading. A sand which consists largely of soft particles, or is too fine, or contains a large percentage of impurities may properly be rejected on the basis of field inspection.

The grading of aggregates with reference to the amounts passing certain sieves can be determined roughly by means of a set of portable sieves. In the case of coarse aggregates a visual inspection will reveal the presence of large amounts of clay, or soft pebbles in a shipment of gravel, and will indicate whether the material deviates largely from the proper grading.

A fairly exact determination of cleanness of sand may be made in the field by filling a cylindrical glass jar or bottle about half full of sand and adding sufficient water to cover the sand to a depth of 2 or 3 inches. Close the top of the vessel and shake vigorously for a few seconds; then set aside and allow the suspended material to settle on top of the sand. The length of time required for the water to become clear and the depth of the deposit on the surface of the sand give a measure of the foreign material present. If a graduated glass cylinder is used for this purpose a more accurate determination of the silt content of a sand can be obtained. This method sometimes fails in the tests of sands which, on account of the color or grading, do not show a line of separation between the silt and sand. It should be noted that the results of this test cannot be compared directly with those obtained by the

usual laboratory methods made on the basis of the loss of weight. In the field test mentioned above, the silt is determined on the basis of volume; the results are also influenced by the fineness of the silt and the effect of the buoyancy of the water. This test will show a silt content varying from 60 to 200 per cent of that found by the laboratory method in which running water is used and in which the loss is determined on the basis of weight.

Certain engineering organizations have provided their field inspectors with outfits consisting of two or three sieves, a glass graduate, rule, etc., which in the hands of intelligent men may be expected to give fair indications of the literature on the use and testing of concrete aggregates.

While the evidence of field inspection and tests should never be overlooked, it is generally recognized by progressive engineers that such tests are not sufficient for the purpose of discriminating between several lots of available materials, all of which may be of a good grade. Field tests may enable the engineer to determine whether a material complies with certain minimum requirements of a specification, but they give no reliable indication of the relative merits of different materials, and may prove wholly misleading. Field tests such as those described above reveal the presence of impurities, but they give no indication of their effect on the setting and hardening of the cement and on the final strength of the concrete.

Production of Cement in Japan During the past Seven Years

A commodity that has made a great advance in volume of business and profitable returns to the Japanese producers is cement. The total output of cement in Japan during the past seven years is as follows:

	Output.	Domestic sale.	Export.
1900	2,540,000	1,986,000	149,000
1910	2,639,000	2,520,000	231,000
1911	3,192,000	3,302,000	67,000
1912	3,803,000	3,256,000	48,000
1913	3,741,000	3,528,000	148,000
1914	3,625,000	3,611,000	249,000
1915	3,943,000	3,273,000	668,000

"It will be seen," says the Japan Chronicle, "that in 1915 the output and the demand for cement were almost equal. From this year onward there will be a growing increase in output, while the future prospects of the export trade in this line are not very encouraging. It is estimated that, as compared with 1915, the output this year will show an increase of 522,000 barrels and next year of 3,235,000 barrels, while the increase for 1918 will amount to no less than 7,691,000 barrels."

Sauerman Power Scraper for Sand and Gravel Plants

A new idea for your study and investigation in a power scraper and its operation—delivering at a speed of 200 feet per minute—returning at a speed of 600 feet per minute—is presented in the new book on the Sauerman Power Scraper which Sauerman Bros., 1139 Monadnock Block, Chicago, have just received from the press. An idea of the possibilities of economic installation for your job may be gained from the many illustrations of actual work which the scraper is now performing—at a cost much lower than that possible with any other equipment.

If you move material—earth, sand, gravel, broken stone, etc.—over long or short spans, from a bank,

stream or pool, to a fill, hopper, car or container of any kind, this illustrated book will eventually save you money. It may be had for the asking.

Vermont Crushed Marble for Facing Concrete work

The Middlebury Marble Company, general offices at Brandon, Vt., with quarry and mill at Middlebury, Vt., have just finished installing a crusher plant of 30 tons' daily capacity at their Middlebury mill, where they will grind selected stock, not suitable for shipping, into Granito for the terrazzo flooring trade and for facing concrete work. The product will be assorted into four sizes. The material is of a cream white color and is pronounced by experts to be the equal of imported Italian.

The regular line of this company is getting into rough marble stock for the jobbing trade and for mills having their own sawing facilities, also exterior marble for the building trades.

The Meadowbrook Marble Company, an associated company under the same management, have their new quarry at Brandon, Vt., well opened and are now shipping blocks and have construction work under way on their new mill.

They will be pleased to send sample of their crushed marble for concrete work on request.

Lehigh Buys Iola Cement Company

Officials of the National Bank of Commerce of St. Louis, Mo., announce the sale, for approximately \$1,000,000, of the Iola Portland Cement Company, Iola, Kansas, to the Lehigh Portland Cement Company of Allentown, Pa., who have recently purchased the Chicago Portland Cement Company at La Salle, Ill. The National Bank of Commerce was the largest stockholder of the Iola Company.

According to George Lockett Edwards, attorney of the bank, the terms of the sale call for the delivery of the institution's holdings in the Iola Portland to the Lehigh Portland Company within 30 days after January 15.

The National Bank of Commerce holds 62,000 shares of the common and 26,000 shares of preferred stock of the Iola Portland. The terms of the sale are \$4 a share for the former securities and \$25 a share for the latter. At these figures the bank will receive \$898,000 for its holdings.

The Lehigh Portland Cement Company is an Eastern concern, and has plants located in Iowa, Illinois, Indiana and Washington.

Concrete Roads

At the fall meeting of the Portland Cement Association held at the Hotel Statler in Detroit during the week of September 11, Edward N. Hines, chairman of the board of county road commissioners, Wayne county, Mich., read a very interesting paper on "The Concrete Road." Mr. Hines presented figures to show the increased property valuation resulting not only in Wayne county but in Detroit, attributable directly to the extension of Wayne county's concrete road system.

From October 1, 1906, to October 1, 1915, assessed valuation of townships, villages and cities outside of Detroit showed an increase of 117 per cent, while the increase in assessed valuation for the same period in the city of Detroit was over 57 per cent.

A New Wet Process Mill for the Oregon Portland Cement Co.

This article deals with a novel method adopted to handle the "slurry" feed for the rotary kiln
Contributed by D. C. Findlay, Chief Engineer, Oregon Portland Cement Co.

On June 1, the Oregon Portland Cement Co. placed in operation a new 1,200-bbl. cement mill at Oswego, Ore., using the wet process, which is noteworthy for several reasons, chief of which is its cleanliness and freedom from dust nuisance.

This article deals with a novel method adapted to handle the "slurry" feed for the rotary kiln. The "slurry" is ground with a Smidth Kominuter (driven by a 150-h. p. Westinghouse three-phase, 440-volt motor, equipped with a Lenix drive) as a preliminary grinder and finished with two No. 85 Type E Cylpeb tube-mills (driven by 200-h. p. Westinghouse motors, equipped with Lenix drives) which reduce the fineness to 90 per cent on the 100 sieve. It is then discharged by means of a 12-in. screw conveyor into either of three correcting basins, from which it is drawn to a large mixing basin holding about 1,000 bbls.

An air lift pumping system then pumps it over a 2,000-bbl. reinforced concrete storage basin which is 26 ft. deep, and is built between the 4th and 5th piers of the 210-ft. Vulcan rotary kiln, and directly under the kiln. This storage basin has its bottom 16 ft. below floor level and is mechanically agitated by three vertical agitators.

The almost universal practice previously has been to pump the "slurry" from the storage basin to the kiln feeder, using three plunger vertical motor driven pumps. Owing to the nature of the material it is hard to pump, and the wear on piston plungers is great, as is the expense of renewing packing, which must be of the highest grade; also a large quantity of oil is required for lubrication. If the packing is not perfect, the pumps soon become very dirty and the floor covered with semi-liquid slurry.

To overcome this, the writer designed a reinforced concrete continuous bucket elevator casing as shown in Fig. 1, 7 ft. 6 in. by 6 ft. 6 in. outside, and 70 ft. 5½ in. in height. In order that continuous operation might be assured, a center partition divides the elevator into two separate units, so that in case of trouble on one side the other side may be placed into service, and used to feed the kiln; or should a chain break with slurry in the leg, by closing a valve to the storage basin, the other elevator can be used to empty the damaged one for repairs.

It will be noted that the slurry is fed into the bottom of the two elevators, through 8-in. pipes connected each through a gate valve and tee to a common 8-in. pipe, concreted into the bottom of the storage basin. Therefore the slurry stands at the same level in the elevator legs as it does in the basin, and the elevators must stand the bursting pressure of a head of 26 ft. of slurry weighing about 108 lb. per cubic foot, and containing about 40 per cent water.

The walls as built are only 9-in. thick, and are absolutely watertight. No waterproofing solution was used, nor were the walls plastered.

The concrete mixture for the first 31 ft. 9 in. was a 1:1½:2 mixture using screened gravel, and was thoroughly mixed and tamped to fill all voids.

The drawing shows the method of reinforcing. All horizontal bars had hooks turned on the ends fastening around the vertical corner bars, and securely wired at every intersection.

The bottom sprocket and bearings are thus completely submerged. Solid and cast iron bearings were

used, being unbabbitted and bored to a fit of only 1/1000 in clearance. Three-eighth-in. compression grease cups connected to pipes cast into the walls are used to force grease into the bearings for lubrication, and to prevent any tendency for slurry to work along the shaft.

No take-ups were used, but the bearing bolts were left up 6½ in. and the bearings blocked up on steel

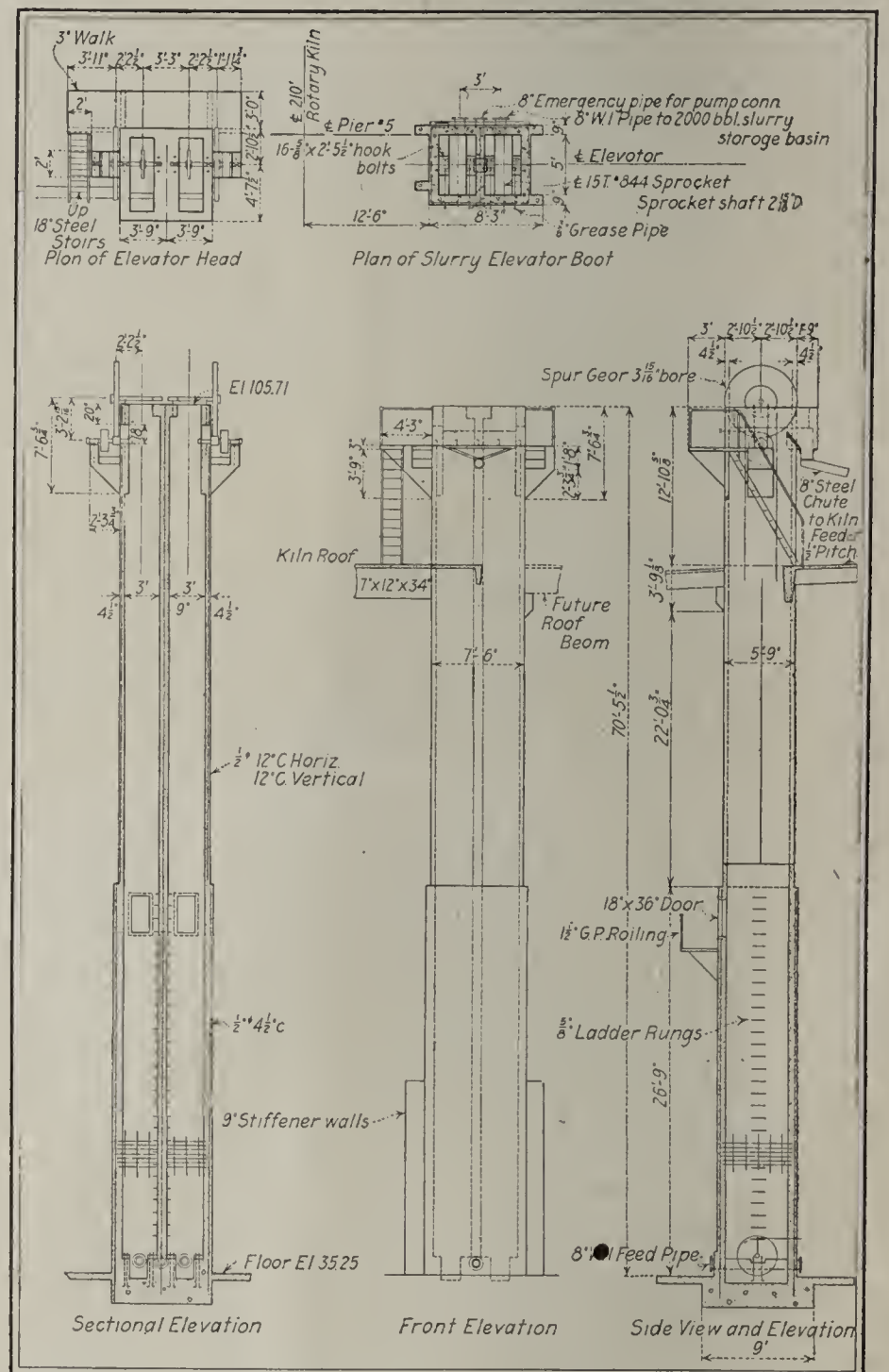


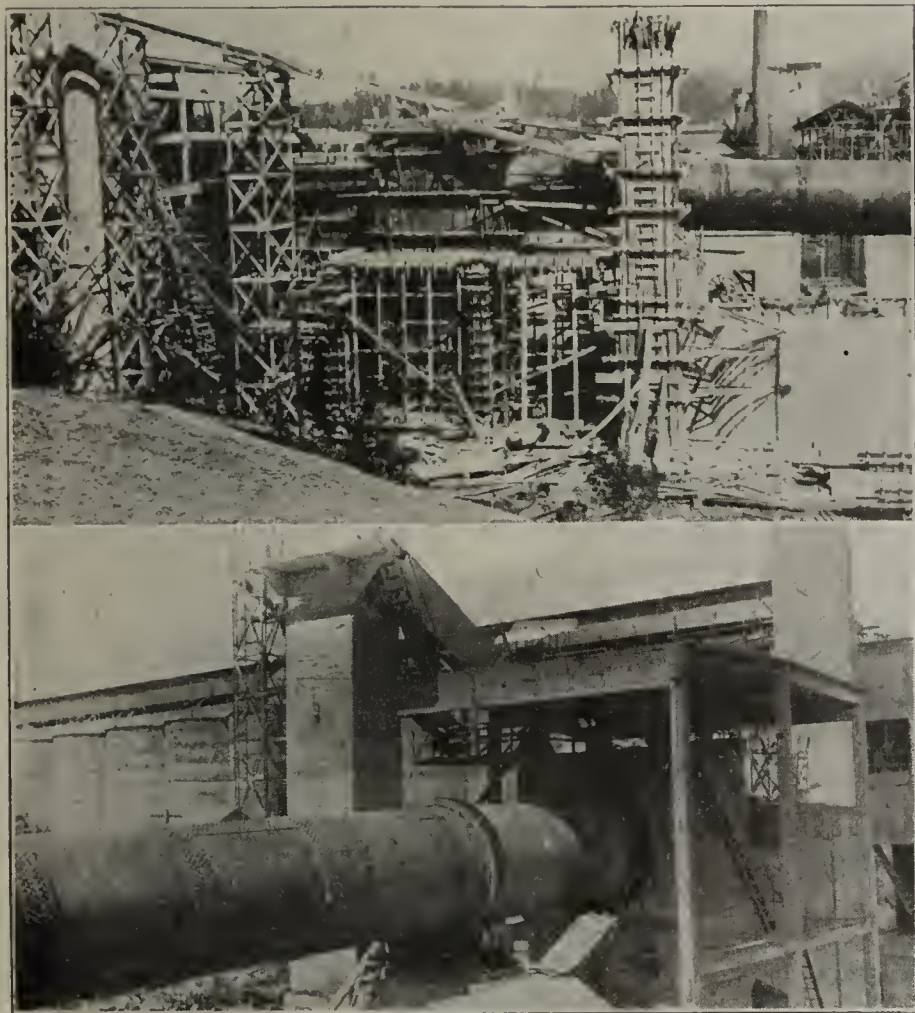
Fig. 1—Sectional Elevation, Front Elevation and Side Elevation of Reinforced Concrete Slurry Elevator.

wedges on starting, to allow for lowering same as wear lengthened the chain. These anchor bolts had lock nuts, and were drilled for cotter pins also to prevent the nuts coming loose. As No. 844 Manganese steel chain was used there will be very little wear.

Wrought iron, continuous type V-shaped buckets were bolted to the chain, using K 2 attachments every 2 ft. A 28-in. No. 844 traction wheel is used at the top and the detail of drive is shown in Fig. 1, also the method of widening out the walls to carry the heavy three 15/16-in. bearings. The pinion shaft with pinion and drive pulley is carried with one bearing set in the wall and the other by an outboard bearing on a heavy concrete bracket from the wide walls.

A reinforced concrete slab walkway (see Fig. 2) carried on brackets from the walls enables the operator to get around the elevator head and a set of steep steps leads to the concrete roof over the kiln.

A steel chute is securely bolted to the concrete, from which an 8-in. steel pipe leads to the automatic "Ferris" type slurry feeder which has four buckets on a horizontal shaft driven by a 2-h. p. Westinghouse variable speed motor. These buckets lift out a defi-



Upper: Reinforced Concrete Elevator Under Construction.
Lower: General View of Concrete Elevator and 210-ft. Vulcan Kiln.

nite amount of slurry each revolution, and deliver same to the kiln. The overflow goes back to the storage basin to be elevated once more.

An 18-in. x 36-in. door is built into the walls above the level of the slurry, and $\frac{5}{8}$ -in. ladder rings in the walls give access to the bottom of the elevator boot, also a ladder outside leads down to the gate valve which cuts off the slurry from the basin.

It happened that the elevator came directly where a roof column should be to support the concrete roof, so the roof beams were framed into the walls as shown, and brackets left for attaching the future roof over the second kiln, at which time the elevator will be completely surrounded, and project 12 ft. 10 in. above the roof, unsupported.

The elevator has been in service for three months now with excellent success, and with practically no maintenance. Each elevator is driven by a belt from a countershaft on the kiln housing, and only requires about 5 h. p. to operate.

On account of the various steps in the walls, etc., movable forms were not used, but forms were built up in and about 15-ft. sections and concrete poured, after which the next section was built. The accompanying illustrations show the elevator in various stages of completion. The writer believes there is a great future for the concrete elevator leg, as it combines great strength with great wearing power, where handling abrasive material or where waterproof requirements are needed, and at a price much less than can be built using steel. The writer built his first concrete elevator in 1912 at Tod Inlet, B. C., and has

since built six with very gratifying results. The Oregon Portland Cement Co. also have a single leg concrete elevator, 56 ft. high, handling clinker, which is a most abrasive material. The design and supervision of construction for the Oregon Portland Cement Co. was in charge of the writer.

In the quarry the rock is loaded in hopper-bottom cars and is dumped into a concrete, steel-lined hopper feeding a No. 7½ Austin gyratory crusher, which reduces the rock to about 3-inch maximum size.

The entire mill is motor driven. Power is furnished at 57,000 volts and is stepped down to 440 volts by 1,000-k. v. a. transformers. The complete electrical equipment was supplied by Westinghouse Electric & Mfg. Co.

The 210 ft. rotary kiln was supplied by the Vulcan Iron Works, Wilkes-Barre, Pa.

Concrete Pipe

Among the first land to be irrigated by the Mormons some twenty-six years ago in Utah was an area lying about thirty-five miles northwest of Ogden and bordering on Great Salt. As happens in the arid regions where irrigation is necessary to carry on agriculture, this land has become so waterlogged that to restore it to its original productiveness drainage became necessary.

With this object in view, the Corinne, Utah, Drainage District was organized and bonds voted to the extent of \$175,000 to raise the necessary funds to reclaim these lands. It is noteworthy that after some promotional work by the Portland Cement Association, which was represented by C. M. Wood, manager of the Cement Products Bureau of that association, the sponsors of this drainage district have been converted to the use of concrete pipe for the development of this region, which will require something over 200 miles of pipe. The quantity of cement that will be utilized in this particular work will range from 8,000 to 10,000 barrels, which is not so large an amount as one would naturally expect, simply because few pipe of large diameter are necessary in the development.

W. M. Bostaph, a prominent civil engineer of Salt Lake, has been selected as chief engineer of this work.



Fig. 2. View Looking Up at Top of Elevator.

Fig. 3. General View of Elevator and Feed End of Kiln.

Granite Concrete Piazza a Work of Art

The illustration is of the piazza erected at the residence of Max Blumberg, one of the wealthy citizens of Terre Haute, Indiana, by the Pettyjohn Company who make a specialty of art concrete products. The columns, rails and balusters are made of a mixture containing genuine New England crushed granite, Medusa White Portland Cement and Medusa Waterproofing powder. All of the work was made in iron and steel molds.

This piazza has a broken ashlar foundation, and terrazzo floor made with gray cement mixed with Italian marble. In the body of the floor white marble predominates, and the border has red oxide of iron in the matrix with various colors of marble intermixed. Composite Ionic columns rest upon a modern design of



Granite Concrete Piazza on Residence of Max Blumberg, Terra Haute, Ind.

pedestal. The two ornamental Grecian vases are of a special formula, the basis of which is Medusa White Cement.

Upon close inspection and at a distance this work closely resembles natural New England granite and it also rivals it in durability, while the cost is only a fraction of what the genuine granite would be. This is generally regarded as one of the finest piazzas in this part of the country.

Properly Made Drain Tile of Concrete

For several years reports of the disintegration of concrete tile have been coming to the Experiment Station. The causes of the disintegration have been variously ascribed to many different factors, and the opinion has become quite general that concrete drain tile are not durable when laid in muck soils. Because of the lack of definite information on this subject the Division of Chemistry and Farm Mechanics of the Experiment Station at Three Rivers, Mich., undertook an investigation of the problem. A number of farms where failure with concrete tile had been reported were visited and the drains examined. Tile, in various stages of disintegration were found in practically all types of soil and in every drainage system examined sound tile as well as disintegrated ones were found. This indicated that neither the soil nor the soil solution could be the primary cause of the trouble.

Upon gathering information in regard to the manufacture of the tile used in the drains it was at once evident that they had been made under widely varying conditions and that in some cases the tile had been laid very soon after being made and before the hardening process was complete.

After securing considerable data from field observations a number of laboratory experiments in making tile, and subjecting them to the action of various solutions were carried on. The evidence obtained from these experiments and observations points to the inevitable conclusion that the primary cause of the disintegration is in the making. On this point too much emphasis cannot be laid.

The materials used and the various steps in the process of manufacture require careful attention. Any standard Portland cement, if properly stored, is satisfactory. The sand and gravel should be clean and

free from clay or organic matter. For tile up to ten inches in diameter the gravel should contain no particles larger than that passing through a $\frac{1}{4}$ -inch screen. The sand and gravel should be graded so that when mixed with the cement there will be just enough fine material to fill one sack of cement to three cubic feet of gravel is recommended. Just enough water should be used so that after forming the casings may be removed at once.

The tile should show trowel marks on the inner surface and weblike markings on the outer surface and they should be uniformly packed so as to insure a dense tile wall. A porous tile wall should be avoided since the passage of the soil water through the tile wall will gradually dissolve some of the cement in material. Finally special attention must be given to the curing or hardening process by supplying moisture at all times to keep the tile thoroughly moist during the process of setting, for no matter how much care is given to the other steps in the process of making, if the tile are not properly hardened unsatisfactory results will follow.

Concrete tile that are made in accordance with the best recognized process should become better rather than poorer when placed in the drain and one could reasonably expect such tile to last indefinitely.

A more complete report of this investigation has been published in Special Bulletin No. 75 and those interested may secure a copy by applying to Division of Chemistry, Experiment Station, Three Rivers, Mich.

JAEGER MIXERS of 1917 are NOW ANNOUNCED

GET FULL
INFORMATION
NOW



SEE US AT
THE CHICAGO
CEMENT SHOW

Changes in design and construction of the automatic side loaders have been made to simplify and better same.

Mixers now go to you all set up ready to use.

Weight has been reduced by using steel instead of cast iron.

Conical—Revolving—Tilting Drum type of mixer with the best known labor saving devices causes the Jaeger mixers to be recognized the LEADER of all makes.

THE JAEGER MACHINE COMPANY 212 W. RICH STREET
COLUMBUS - OHIO

The Questions — The Answers

Mixers have been made too much for the seller. Contractors have long wanted a machine with more **serviceability** to the square inch, more "backbone" to resist the ravages of hard service. *We* knew there was such a want. We believed that a mixer conscientiously supplying those needs would sell and **continue** to sell. We asked hundreds of contractors:

What are the features you like best in the machine you are using?

What faults have you found in mixers?

Where do you find the greatest need for increased strength?

How do you think greater speed, greater economy could be acquired?

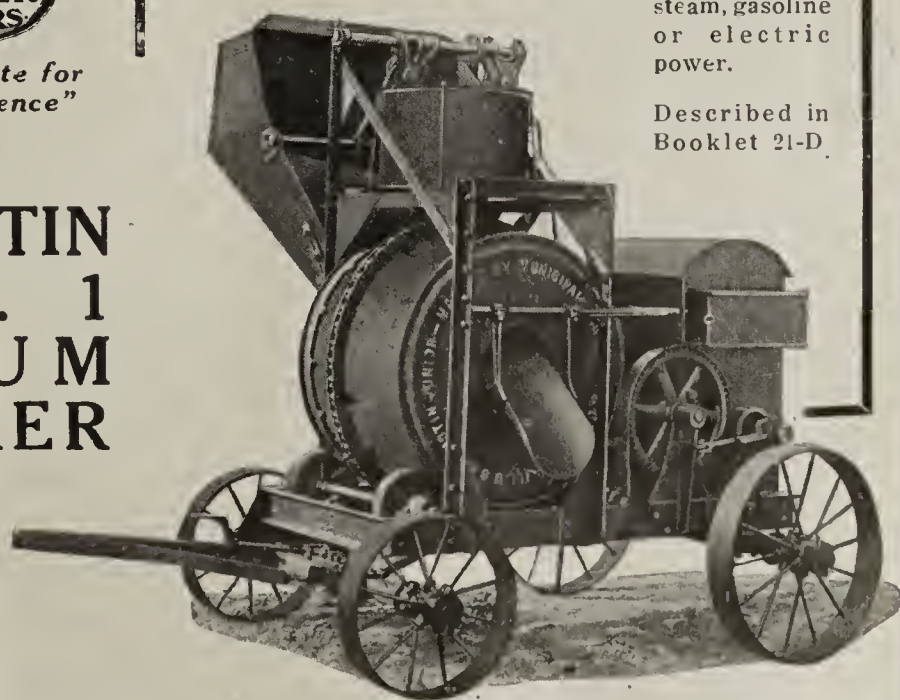


"Concrete for
Permanence"

The
**AUSTIN
NO. 1
DRUM
MIXER**

Capacity, 6 cubic feet mixed material. Operated by steam, gasoline or electric power.

Described in
Booklet 21-D.



See our Exhibit of Austin Cube and Austin Drum Mixers at the Tenth Chicago Cement Show, February 7th to 15th.

MUNICIPAL ENGINEERING & CONTRACTING CO.

MAIN OFFICE: RAILWAY EXCHANGE BLDG., CHICAGO

New Eng. Agts: Dyar Supply Co., Cambridge, Mass.

New York Office: 30 Church Street

Ontario: A. A. Scully, Stair Bldg., Toronto, Canada

Pacific Coast: J. H. Hansen & Co., San Francisco; Howard, Cooper Corp., Portland; F. S. Burbank Co., Seattle

Agents Wanted in Open Territory

Big New Block Plant at Painesville, Ohio

A concrete block manufacturing enterprise which is being watched with more than usual interest is that of the Ohio Cast Stone Company at Painesville, O.

This company is manufacturing under the Zagelmeyer patents and the handsome granite-faced blocks which are being turned out are a revelation to the people of that locality.

The plant which this company has built at Painesville is characterized by some men in the business as better than is necessary. It was designed and its construction supervised by Mr. Frank J. Schrey, the secretary and general manager of the company, who was for many years a mechanical engineer and who insisted that the plant should be designed and constructed along the very best lines.

The plant has a row of curing tunnels comprising 20 curing rooms. An additional row of curing rooms will be constructed when the output of the plant is such as to demand it.

The plant has a main factory room, 127 feet long by 32 feet wide. A Koehring mixer, size 24, is located at one end of this room, and back of it is a platform connecting directly with the gravel storage from which the hopper of the mixer is charged.

The entire $7\frac{1}{2}$ acres of land occupied by the plant is underlaid with a good grade of sand. This is brought up an incline by Lakewood cars to the gravel storage room. The cars are brought up the incline by a hoist located on the platform back of the mixer. It is operated by the mixer operator and is driven by the same shaft to which the mixer is connected.

The mixer is placed at such an elevation that it can discharge directly into the cars of Zagelmeyer molds. A track runs out directly in front of the mixer for carrying these cars and connects with the main transfer track of the plant at about 15 feet from the mixer, this transfer passing directly through the plant and out into the yard to deliver the cars to the curing tunnel.

The rest of the space in the workroom, aside from that needed for storing and caring for the molds, and also the space required for the apparatus for putting on the granite facing, will eventually be used for making special pieces, ornamental trim, etc.

The coal shed and cement storage are conveniently located to the railroad cars so that delivery can be made directly from the cars. The boiler room is equipped with a 100-horsepower boiler and the engine room with a horizontal engine of 50-horsepower capacity. The arrangement is such that the exhaust steam from the engine is utilized for heating the curing chambers, and also for heating the plant itself in cold weather. If the exhaust steam is not sufficient for the purpose, or if the engine is shut down for any length of time, the pipes are so arranged that the steam can be turned from the boiler directly into the pipe through reducing valves which bring it down to the pressure needed for heating purposes. It is planned, also, to install a dynamo in the engine room which will manufacture current sufficient to light the plant for night work.

The entire plant has a big capacity in every respect, due consideration in its design having been given to future growth. It is also built along such permanent lines that it will do service for many years, thus making provision for increased production.

The plant is substantially built of concrete blocks, with concrete floors throughout, and has heating capacity for the coldest weather.

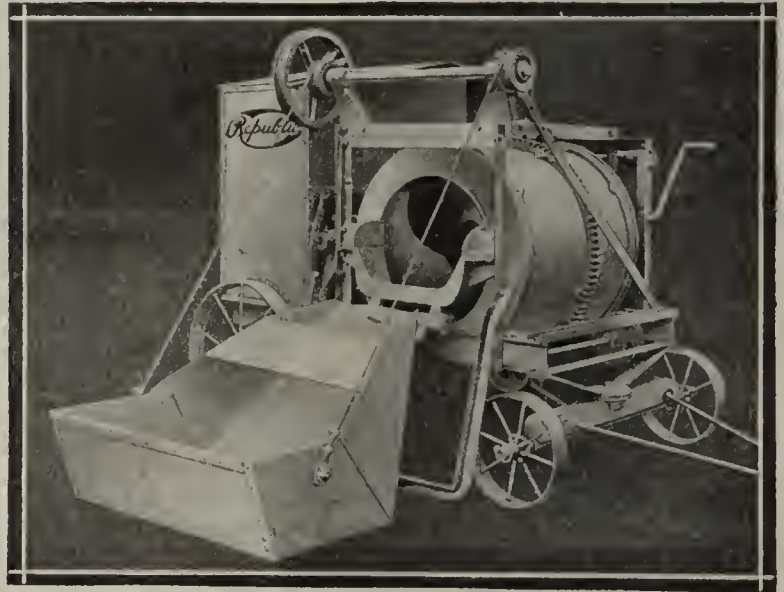
The main office of the Ohio Cast Stone Company is

at 610 Marshall Building, Cleveland, Ohio. In addition to Mr. Frank J. Schrey as secretary and general manager, the officers are Augustus C. Knight of Cleveland, Ohio, president, and H. J. Koenig of Cleveland, treasurer.

A New Light Weight Sack Size Mixer

The new 1917 Model Light Weight Sack Size Concrete Batch mixer, manufactured by the Republic Iron Works, Tecumseh, Michigan, is illustrated herewith.

This mixer was designed to meet the requirements



of both large and small contractors, for a light, easily moved machine, which has sufficient capacity to handle a full bag of cement with all average mixtures, at the same time supplying a machine which is light in weight and more easily transported and placed on the job than the sack size mixers heretofore obtainable.

The popularity of this machine has prompted us to illustrate it in reading columns and call the attention of our readers to this special outfit, which has won its way into the favor of both large and small contractors.

This machine is extremely well made, and has been on the market a sufficient length of time to fully develop it and the present model shows a number of labor saving devices and improvements not ordinarily found on mixers of this type.

In addition to the sturdy construction, it is sold at extremely reasonable prices within the means of contractors and builders in general. Information about this machine also in regard to larger and smaller outfits, block machines, etc., may be obtained by addressing the Republic Iron Works, 116 Patterson St., Tecumseh, Mich., who will furnish illustrated catalogs to readers free of charge, and without any obligation on their part.

DISC FRICTION CLUTCHES

In a cement plant as much of the equipment as possible should be sufficiently simple so that it can be taken care of by ordinary labor.

This is a feature which has been taken into account in the design of the Plamondon disc type friction clutch, made by the A. Plamondon Manufacturing Co., 12-14 North Clinton Street, Chicago, Ill.

These clutches, while effecting easy, instantaneous and positive control of the power, are, nevertheless, so simple in design and construction that they can be taken care of by anyone.

The clutch acts with a double toggle movement, engaging and disengaging the clutch without the use of springs.

The company has a catalog (No. 157) especially covering these clutches which they will be glad to send to anyone interested.

STREICH Dump Wagons



1. Chicago Second Regiment Armory Job.
W. J. Newman, Contractor.

2. Chicago Lake Front Improvement.
The Ryan Co., Contractors.

¶ About 90% of the Dump Wagons purchased in the City of Chicago are Streich's. There is a reason. Our wagons run easily because the axles are properly set, and wear long because they are made of the right kind of stuff.

¶ This wagon will dump anything from cinders to the stickiest kind of clay. Weight of contents of load when dumped automatically forces the bottom doors up the sides of body, allowing bottom doors to clear pile. You never see a Streich wagon stalled and you never see a driver shovel in order to get free after a dump.

¶ We build One and Two Horse Wagons from one yard to four yards capacity.

Write for catalog showing complete line of Dump Wagons, Garbage, and Asphalt Wagons.



A. STREICH & BRO. COMPANY OSHKOSH, WISCONSIN.
CHICAGO OFFICE: 663-665 WEST LAKE ST.



BULLETIN No. 1 covers the possibilities of Drain Tile as a business. This includes materials required, complete costs, selling prices and profits. It tells what others are doing in this business. How the demand is rapidly increasing and why cement tile are preferred by users.

BULLETIN No. 2 covers manufacturing. How to successfully start and operate a tile plant. Points to consider regarding location and building. Arrangement of equipment for best production. Describes different curing methods and relative costs. Tells what proportions of materials should be used and how mixed.

BULLETIN No. 3 deals with selling the product. Best methods to use for securing local business. How to get business from nearby towns. It also illustrates advertisements for use in local newspapers.

The Tile Business Fully Described

This instructive book on cement tile completely covers the three big subjects: **Possibilities of the Business, Manufacturing and Selling.**

It also describes suitable equipment for both large and small plants. For small plants as well as general cement products plant we recommend the Dunn No. 1 Machine, because it can be easily installed, occupying little space and can be operated successfully and profitably by 1, 2 or 3 men.

For large plants we have the Dunn Automatic, which makes a larger tile and has a larger capacity.

We Want Only Successful Plants. We investigate local conditions for any prospective purchaser. If not right, we advise you not to buy. If right, we go the limit with you. We try to eliminate failures. They are not necessary. We cannot afford that risk any more than you can, as every sale we make is absolutely on our 15 days' free trial offer—your money back if not satisfied.

Write today for this tile book. We send it absolutely free.

W. E. DUNN MFG. CO.

414 24th Street

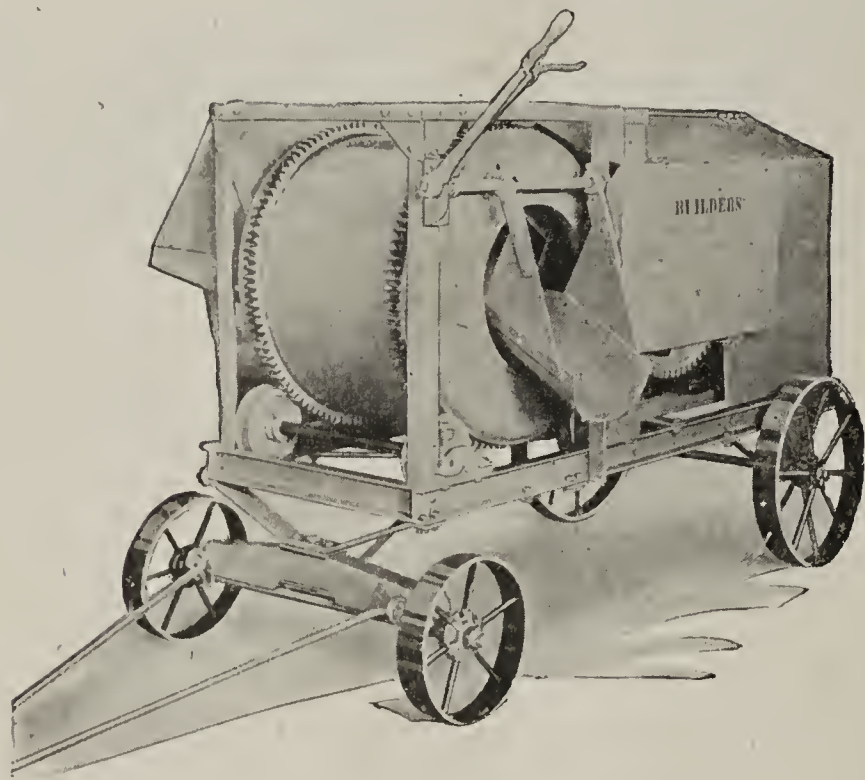
HOLLAND, MICH.

New Double Gear Type Builders' Mixer

An announcement of immediate and considerable interest to builders has just been made by the Contractors Machinery Co., Division of the American Cement Machine Company, Inc., 9635 Johnson street, Keokuk, Iowa.

This firm—well and favorably known as the manufacturers of the Boss and Packard lines of light weight, high speed steel concrete mixers, have just brought out a new mixer of an improved type designed especially for the general use of contractors and builders. It has several features that are well worthy of mention and that will recommend it to the serious consideration of mixer buyers everywhere. Its appeal will be very largely to building contractors, however, as it embodies exactly the points that make mixer value for the builders' jobs.

This mixer—known as the "Builders' Mixer"—is a half sack size low charger mounted on steel trucks and powered by a special gasoline engine. It is steel construction with full engine housing and is substantial and sturdy enough to stand up to any kind of legitimate service with a very low up-keep cost. It is extremely simple in construction and operation—has no complicated mechanism about it and no "ginger



bread." Long experience with mixers is not necessary to its successful operation.

The "Builders' Mixer" is of the high speed type. It has a patented high speed mixing and discharge action that permits of the producing of a perfect mix in minimum time. It "speeds up" the jobs, cuts down the time and labor expense and adds substantially to profits on every job where it is utilized. Its handy size and low charging feature makes it adapted to service on a big variety of jobs and is a farther aid to time and labor-saving.

Perhaps the most interesting feature of this new mixer is its double gear drive—an innovation in the light mixer field that insures a steady running drum, and eliminates all possibility of any wobbling. It is a step in advance and a point in keeping with the general "up-to-dateness" and high quality of the "Builders Mixer."

Another point worthy of mention lies in the fact that this mixer will successfully mix mortar as well as concrete. The makers urge this feature strongly upon the consideration of masons and builders and one in

position to furnish some interesting facts and figures relative to the mixer as adapted to mortar-mixing.

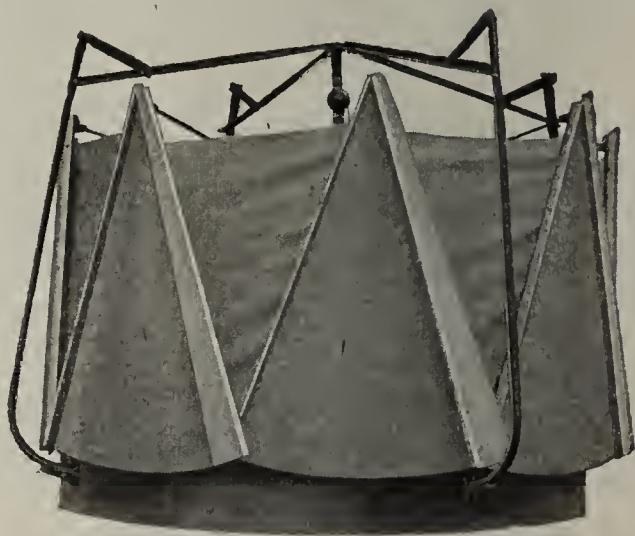
The price—an agreeable surprise to prospective buyers—and complete, detailed information about the new mixer can be had by applying to the manufacturers at the address given above. It will be well worth the while of builders needing a mixer to get the full data on the "Builders' Mixer."

Buckeye Extension Silo Roofs

Every user of ensilage will appreciate the superior advantages of The Buckeye Extension Silo Roof, because it is the simplest and most efficient extension roof on the market today.

It is operated entirely from the ground by means of a rope running through a pulley at the top of the supports and can be opened or closed at any time by a boy standing at the bottom of the silo.

You can pack the silo from bottom to top at one filling and the roof closes with the shrinkage of the contents.



Its construction permits the filling of the silo to extend from 5 to 6 feet above the staves, this making ample allowance for shrinkage and avoiding the expense of a second filling.

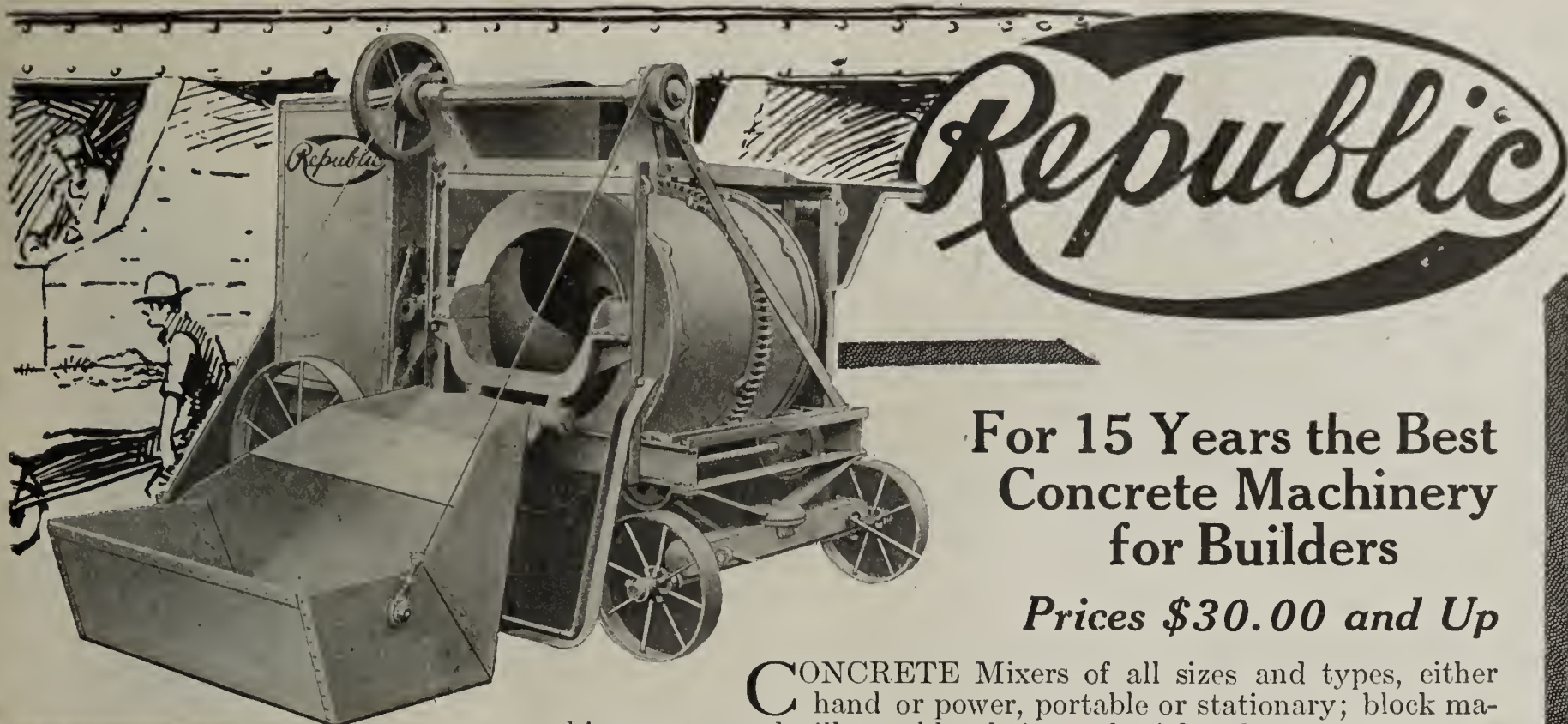
The Buckeye Extension Roof is patented and has the unqualified endorsement of many satisfied users. It fulfills the proper functions of a silo roof in every particular with the added advantage of the extension feature. It is manufactured by the Thomas & Armstrong Co., 119 Main street, London, Ohio, who also manufacture a full line of Third pitch roofs, Gambrel roofs, metal chutes, steel ladders and ladder rungs. Write for descriptive circulars.

CONCRETE PAVEMENTS

Figures furnished by the Portland Cement Association show that contracts awarded for concrete pavements up to December 1, 1916, reached a total of 24,929,148 square yards. Of this total 16,533,129 square yards are roads, 7,501,739 square yards are streets and 894,280 square yards are alleys. There remain to be collected and tabulated the contracts for December which will make the 1916 total go considerably beyond 25,000,000 square yards.

When it is realized that the yardage of concrete roads contracted for in 1916 is over 70 per cent of the total yardage laid up to January 1, 1916, there seems to be good reason for believing that it will be but a question of a few years before the people, when they think of good roads, will think in terms of concrete.

A concrete paved section of the Dixie Highway running through Kenton County, Ky., has just been opened to traffic.



For 15 Years the Best Concrete Machinery for Builders

Prices \$30.00 and Up

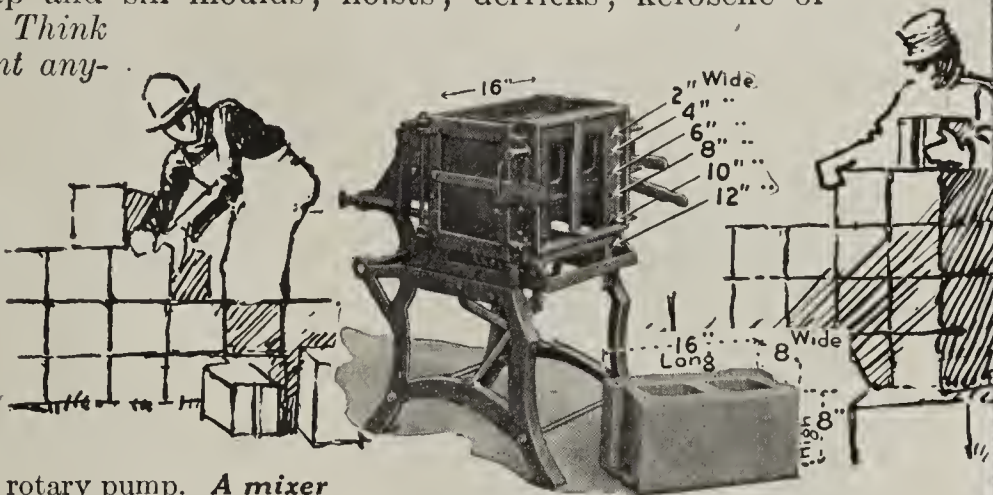
CONCRETE Mixers of all sizes and types, either hand or power, portable or stationary; block machines; cap and sill moulds; hoists; derricks; kerosene or gasoline engines; tools, etc. Think of "Republic" when you want anything in the concrete machinery line.

Republic "Ten"

See this splendid new 1917 model light weight sack size mixer. Can be furnished with either low charging portable platform or automatic power loader. **The best light weight sack size mixer built.** Prices very low.

Republic "Seven"

A medium size mixer of standard design. Equipped with standard hopper, batch hopper, power loader, building hoist, or rotary pump. **A mixer built for service and durability.**



Republic "Five"

An extremely strong and durable medium and small size mixer. One of the best building and small contractors' outfits built. Silo and building hoists, rotary pumps, standard hopper, loader or any equipment you want. **Don't fail to see this mixer before you buy.**

Republic "Three"

A new model mixer for the small contractor and builder. **Lowest prices** combined with long wearing qualities, with convenience in operating and extreme portability. **\$30 and up.**

Monarch Cement Block Machine

Simple, rapid, face down, easy to operate. Adjustable to all standard widths from 2 to 12 inches. Makes blocks with faces in rich effects imitating rock, ornamental stone, etc. **Considered the standard of building block machines.**

Systematic

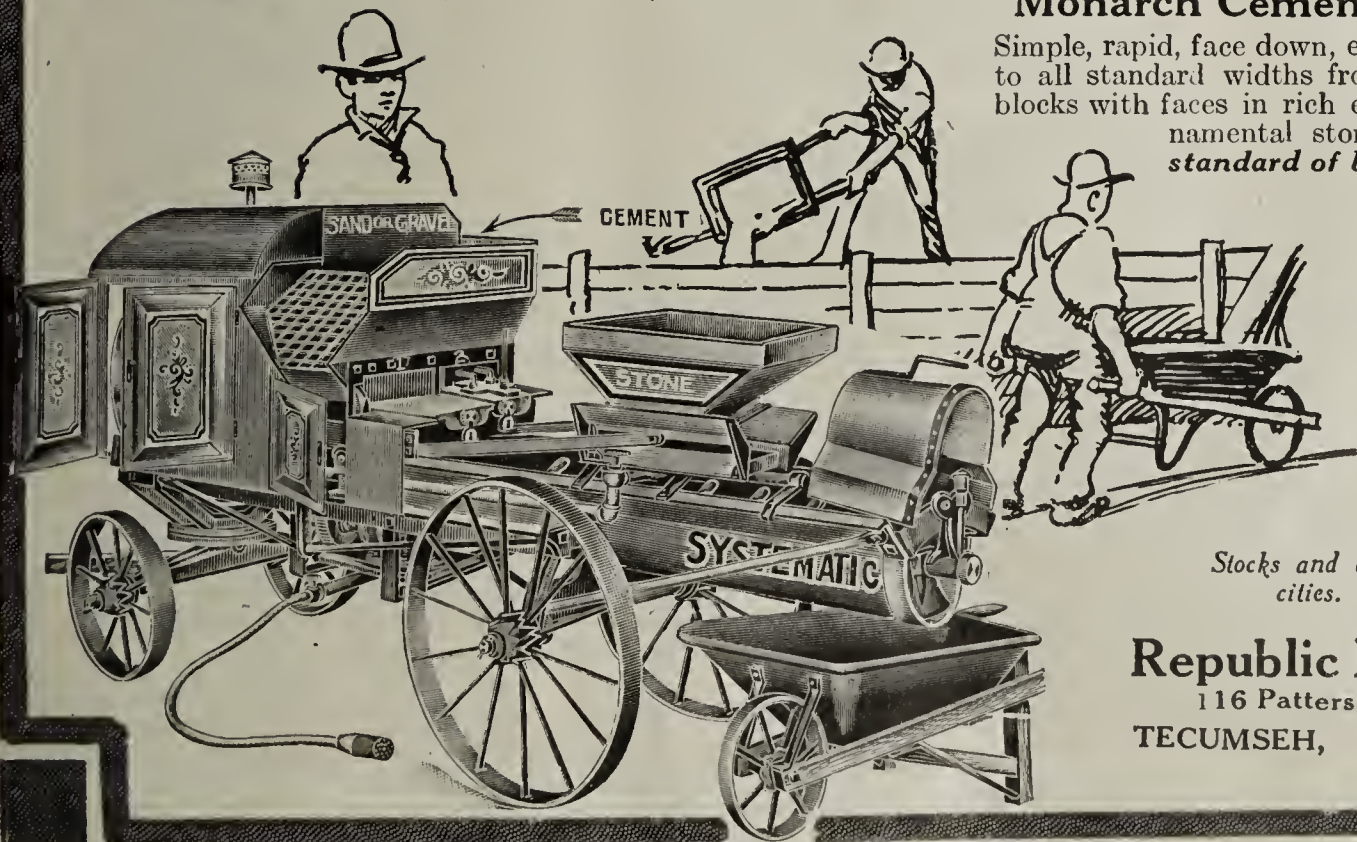
An automatic proportioning mixer with batch principle of measuring. A splendid machine for sidewalk, curb and gutter, and block and tile plants. Built in four sizes, with or without power.

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Republic Iron Works

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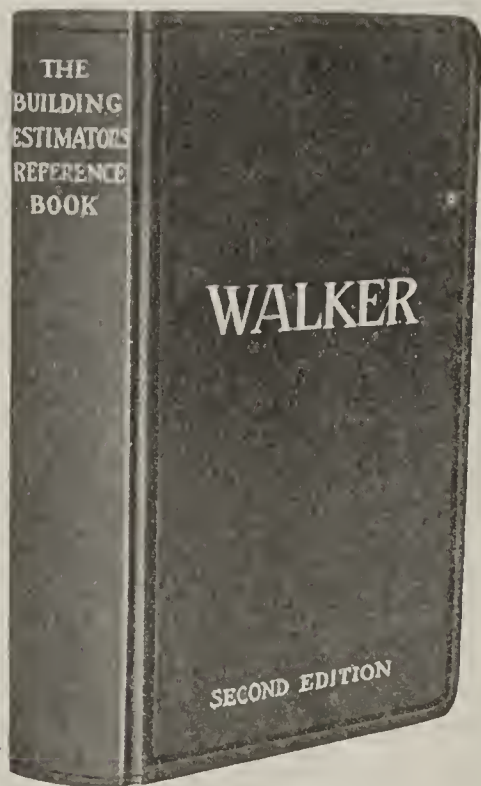


Correct Estimating

Your success as a contractor and builder depends upon your ability to estimate correctly, writes Frank H. Walker, who has just issued the 1917 edition of *The Building Estimator's Reference Book*. If your estimate is too high, you lose the job—but if your estimate is too low, you lose your money. Insure yourself against loss and increase your ability as an estimator and contractor by using Mr. Walker's new book, which protects you against mistakes and losses—checks every estimate you submit—the same as it has been doing for prominent contractors in all parts of the country during the past year—and every one of these contractors will tell you it is the greatest book of **DEPENDABLE** building cost data they have ever seen. The price is 5 dollars.

The first edition of this book, containing 600 pages, sold for \$10 a copy, and was completely sold out 3 months before the present edition was off the press—and now the second edition, containing 1,400 pages, every one brim full of valuable information for the estimator and contractor, is ready for you at one-half the former price—the biggest \$5 worth of building cost data you ever received.

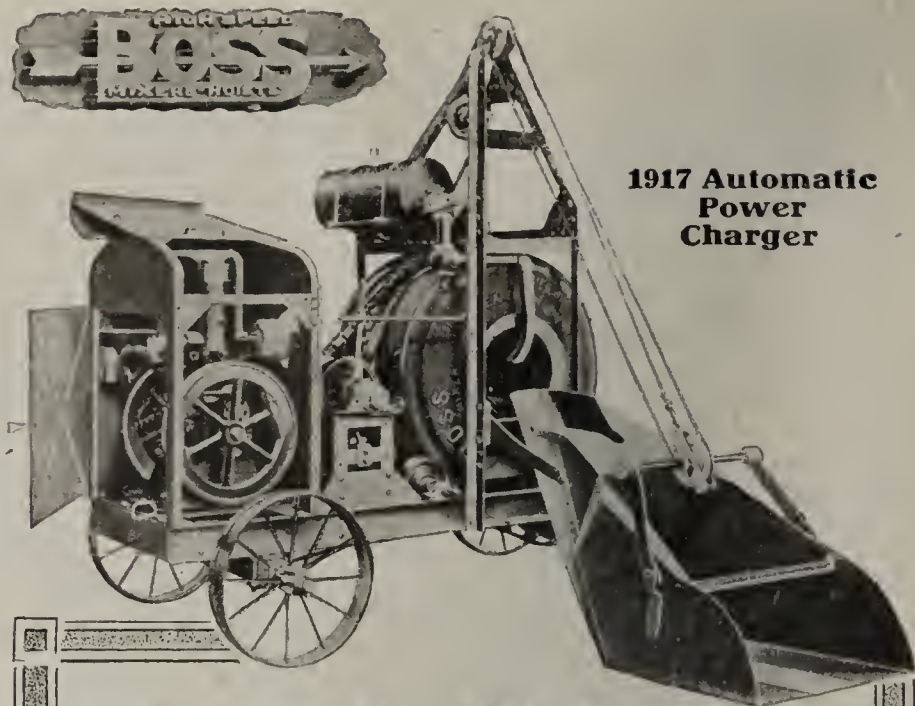
THE ONLY ESTIMATING BOOK PUBLISHED THAT IS ILLUSTRATED, showing the actual conditions prevailing on the job at the time the



costs were obtained, also illustrations showing the most modern and practical methods for performing all classes of construction work, together with the cost of same.

THIS BOOK HAS BEEN REVISED RIGHT UP TO 1917 AND CONTAINS MORE UP-TO-DATE BUILDING COSTS THAN ALL OTHER BUILDING ESTIMATOR'S BOOKS COMBINED, and up to the time of going to press is the only book that has revised its prices to take care of all the radical changes which have taken place during the past year.

The book is a mine of information for contractors and builders, giving detailed costs on mixing and depositing concrete for any class of work—foundations, walks, pavements, or reinforced concrete buildings—and no matter whether the concrete is to be mixed by hand or machine, regardless of the size and capacity of the mixer and the method of distribution, this book contains the information you desire, all compiled for ready reference. Complete tables are included giving the quantity of lumber required to construct one square foot of concrete forms for any class of work and the labor costs of erecting same—costs that will



1917 Automatic
Power
Charger

The "HIGH SPEED" Mixer You Have Been Waiting For

Boss Engineers Score Another Big
Victory for Contractors by--

Patented High Speed Mixing and Discharging Action.

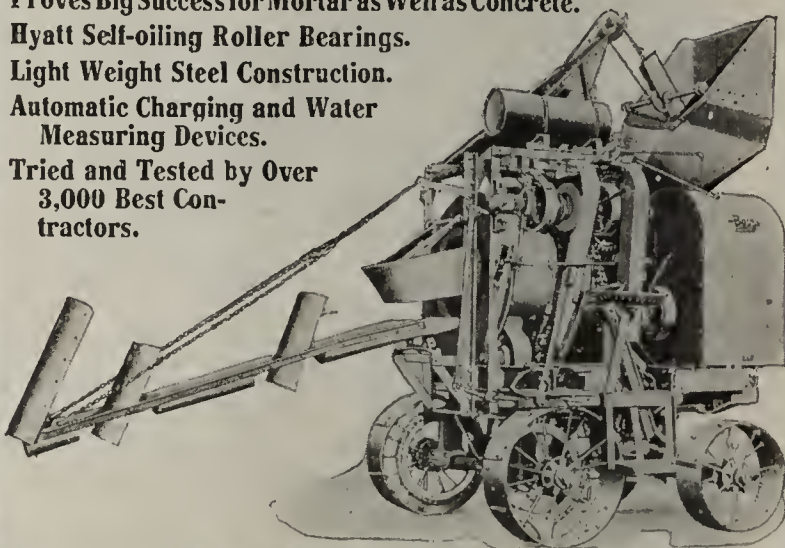
Proves Big Success for Mortar as Well as Concrete.

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Light Weight Steel Construction.

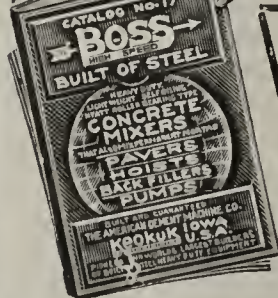
Automatic Charging and Water
Measuring Devices.

Tried and Tested by Over
3,000 Best Con-
tractors.



Lincoln Highway Type
Gasolene or Kerosene Pavers That
Have Proven as Reliable as Steam
and From \$5 to \$10 Per Day Cheaper
to Operate. Several Sizes. Also Small Grouter.

Real News To Contractors
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Write Today



Write or Wire
For Our Low 1917 Prices

**Building Mixers, 5 to
20 ft. Sizes, All Types, In-
cluding Low Chargers--
Pavers and Grouters
--Hoists--Back Fillers
and Pumps.**

Ask About Our Latest \$166.50 Low
Charger as Advertised on
Page 7, This Issue.

THE AMERICAN CEMENT MACHINE CO., INC.

New York
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HOME OFFICE AND FACTORY

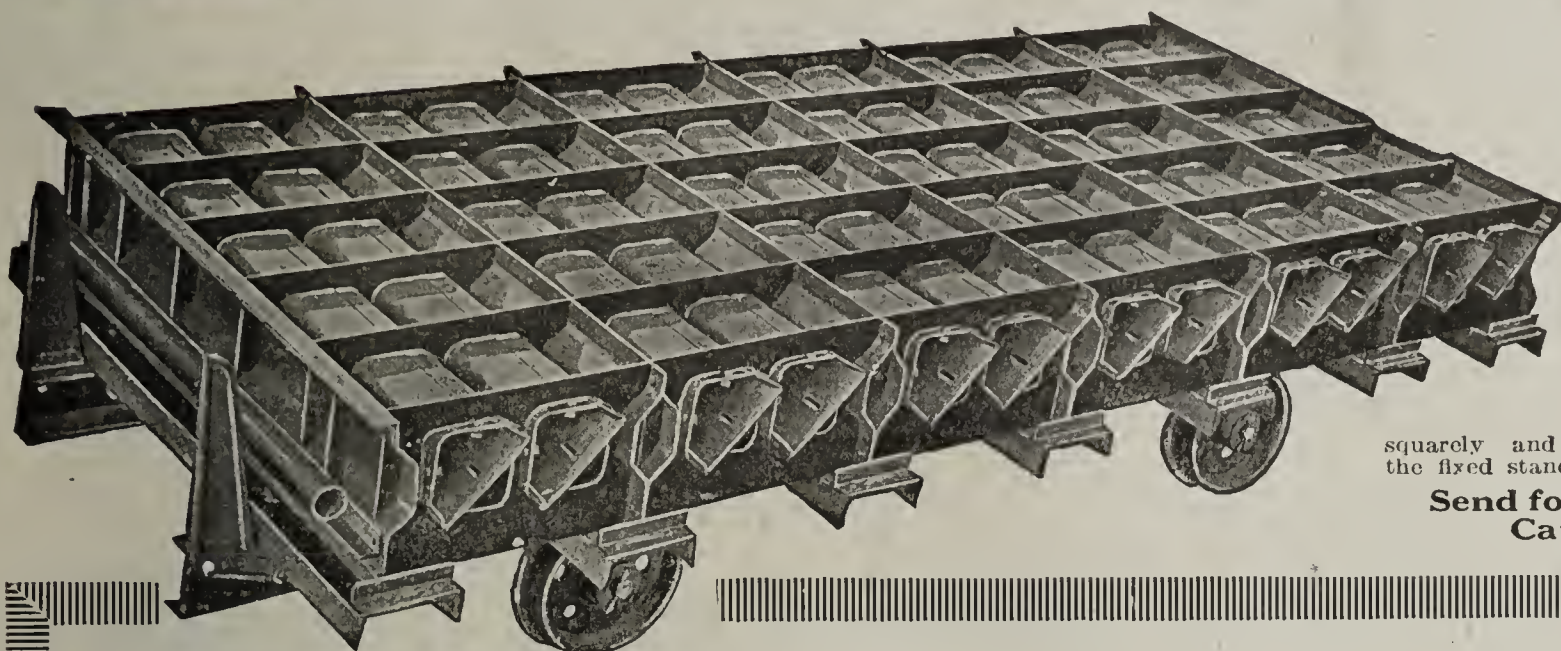
Keokuk IOWA
THE 300,000 H.P. ELECTRIC CITY

Chicago
Seattle
Spokane
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**THE
ZAGELMEYER
SYSTEM**

Thirty 8x8x16-inch Molds mounted on all Iron Roller Bearing Truck. Other Gauges in stock and to order. Either Rock or Plain-face Plates.



This view shows the locking end of molds after molds are set up. By simply placing the locking bar between the ends of the molds and the taper stakes, the molds are all securely locked in position, bringing them up

squarely and snugly against the fixed standard at the rear.

Send for big new Catalog

Quantity Production Means Bigger Profits in the Manufacture of Concrete Blocks

Zagelmeyer Casting Molds and Trucks cut down labor cost and increase your output, decreasing the cost of manufacturing to less than that of making blocks by any other method. In our own plant at Bay City, eighteen men turn out 2300 twenty-four inch blocks daily at an average cost of seven cents each. Granite facing is applied at a cost of two cents per block extra. Compare this low cost with your present cost of manufacturing blocks.

A BETTER BLOCK

You can make granite veneered water-proof building blocks by the Zagelmeyer System that will eliminate competition. You can make them for less, sell them for more and

sell more of them than any other blocks made. Adapted to practically all construction purposes. Zagelmeyer blocks open up a wider field of possibilities for the block maker who secures the exclusive rights to use the Zagelmeyer System in his territory.



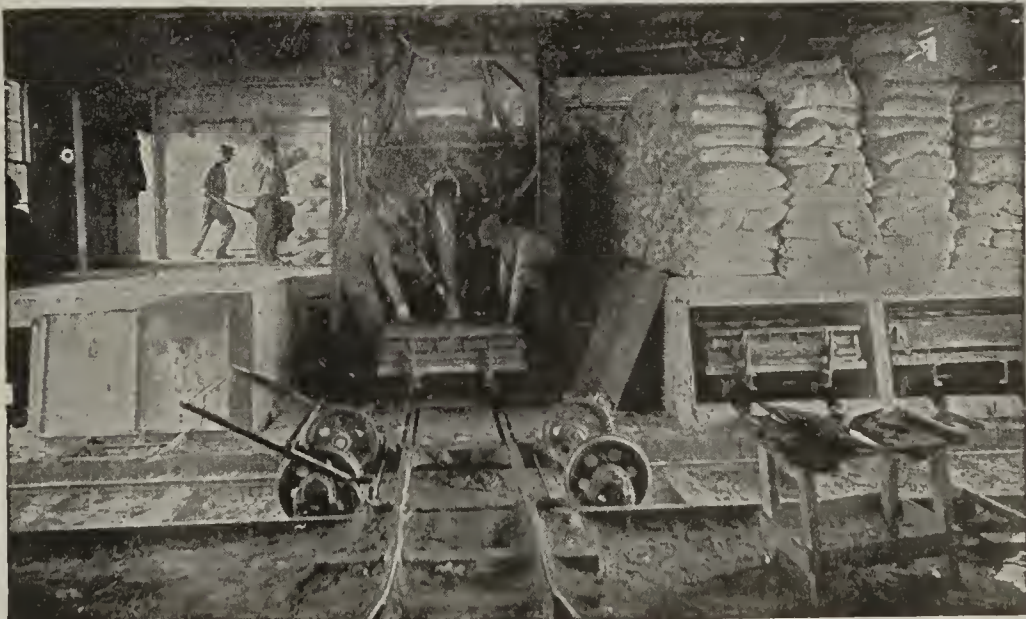
SEND FOR SAMPLE BLOCK

"Send 50c in stamps for sample of 24" Granite Faced Block, shipped prepaid to all points east of Mississippi and north of Ohio rivers."

Labor-Saving

The entire operation is so simple and the amount of labor required so little that no other method of making cement blocks can compete in cost of manufacture. We build complete plants with capacities from 500 blocks per day up and turn them over to the purchaser in complete working order, or we will sell the cars, molds and full equipment and the purchaser equips his own plant. Our process is fully protected by process patents and we can give you an exclusive monopoly of the business in your locality. Write for our proposition today.

ZAGELMEYER
CAST STONE BLOCK
MACHINERY CO.
25 Crump Ave., Bay City, Mich.



Zagelmeyer Trucks and Molds make possible use of other labor-saving equipment.

save you time and money. Costs on handling, bending, and placing reinforcing steel for all classes of buildings. Costs on handling and placing concrete blocks of all sizes and shapes—in fact the most complete collection of concrete cost data ever published.

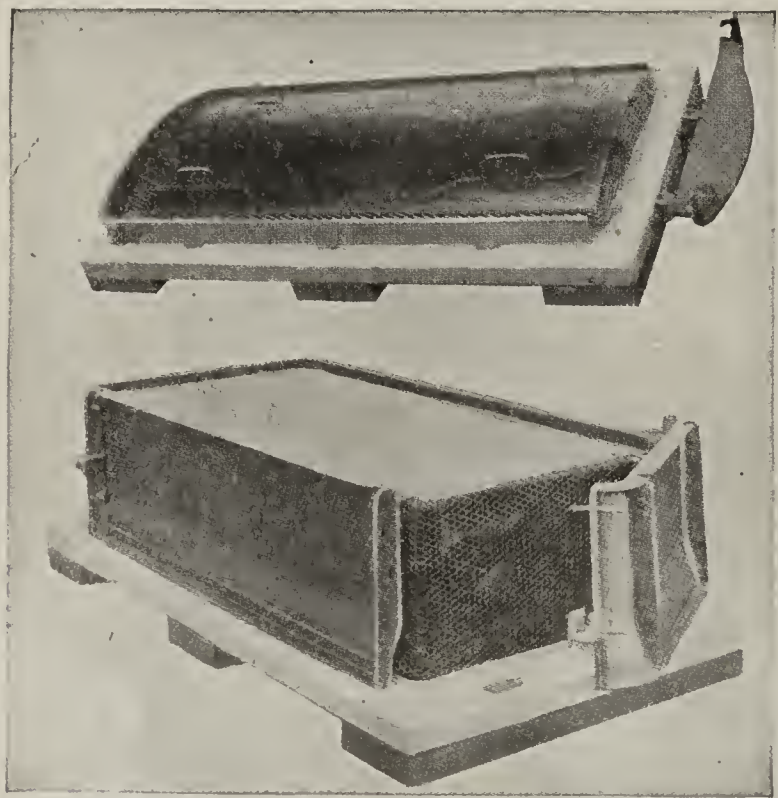
The following are a few of the many important subjects treated in this book:

How to estimate the allowance for Overhead Expense, Contractor's Liability and Workmen's Compensation Insurance, Bonds, Excavating and Back-filling, Concrete, Brick, and Cement Block Foundations, Cement Floors, Sidewalks, Street Paving, all classes of Reinforced Concrete Construction, Brick Masonry for any type of building, Cut Stone, Granite, Architectural Terra Cotta, Hollow Tile Fire Proofing, Cement Block Construction, Timber Framing, Rough and Finish Carpentry, Wood and Metal Lathing and Furring, Plain and Ornamental Plastering, Interior Marble and Tile, Hollow Metal Doors, Windows and Interior Finish, Metal Store Fronts, Sheet Metal Work, Skylights, Cornices, all kinds of Roofing, Iron Stairs, Miscellaneous and Ornamental Iron, Structural Iron and Steel, Glass and Glazing, Painting and Varnishing, Paper Hanging, Plumbing, Heating, Electric Wiring, Gas Fitting, Automatic Sprinkler Systems, and in fact everything the progressive contractor should know.

Examine the book for five days and convince yourself of its real value—and if you decide it isn't the greatest book of building cost data you've ever seen—return the book to the publisher in good condition. Address Cement & Engineering News, 672 Transportation Building, Chicago.

A. K. Richards

A. K. Richards, now engineer in charge of construction with the Colorado Portland Cement Company, was formerly with Cambria Steel Company, Johnstown, Pa.



Get into the Burial Vault Business

In every town and county in this country there is a big, glowing opportunity for a live man with some capital, some business ability and a lot of energy to found a permanent, profitable business manufacturing the Chicago (Janisch Method) concrete burial vault—for which there is a national demand. No Royalties; Never a Failure. Costs less to make than others, therefore more profit.

It doesn't cost much to start in this business, and it's steady the year around. Write today for our catalog.

Chicago Cement Burial Vault and Casket Company

5301 RAVENSWOOD AVE.

CHICAGO

Roofs for Concrete Silos

Perhaps no one article of farm equipment is attracting more attention than the silo. Almost all types of silos are being built. In the earlier stages it was a mooted question as to covering these silos with roofs. The expense of a roof was considerable. In the cement construction the question of a roof was not only expense but also difficulty in building. It is now universally admitted that silage keeps much better in covered silos. Hence, practically all silos are roofed. To solve the question of expense and convenience of erection a very superior, air-tight and self-supporting



galvanized steel roof has been put on the market by C. E. Martin & Bros., Mansfield, Ohio. For further details, we call attention to their advertisement appearing in this issue. We can recommend this roof to contractors and builders as one of the very best. Easy to erect and a perfect fit. A roof sold with your silo means a better satisfied customer.



Winter

Doesn't Stop the Sealing Vault Business

There is a constant demand the year round. A demand that you can supply with just one set of our Steel Molds. Think how nice it would be to have a neat little income during the winter months and all the year round.

The AUTOMATIC SEALING VAULT

pay big profits from fifteen to 24 dollars on each one. You can develop this as a side line or devote all your time to it. Make the dollars come in this winter

by making the AUTOMATIC SEALING VAULT.

The First Step is to send for information. We'll furnish full details and particulars. Write Today.

The Automatic Sealing Vault Co.

216 East River Street

Peru, Ind.

The Fin-
ished
Vault



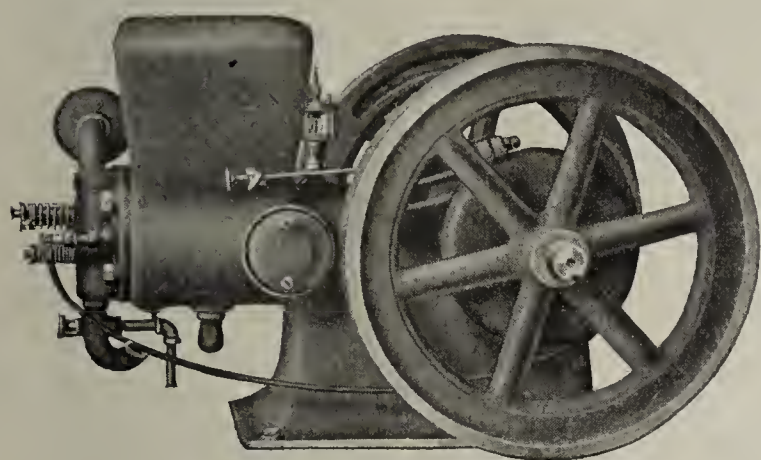
Thompson Plow & Engine Works

Beloit, Wis., U. S. A.

MANUFACTURERS

PAN-AMERICAN GAS ENGINES

Equipped with built-in High Tension Crank Shaft Magneto mounted directly on the Crank Shaft. No Brackets, Gears or Fixtures.



We make a specialty of Home Lighting Plants, Glass sealed jars, fully charged and ready to operate as soon as erected. These superior Lighting Plants in connection with our Pan-American Engines are sold at remarkably low prices which make them within reach of every farmer. It is the modern system.

Thompson Engines are extensively used for operating Concrete Mixers. Safe and reliable.

Write for catalog

BULL FROG Wheelbarrows



"I Am A Champion of Progress"

THE BULLFROG BRAND

We manufacture with this idea only in view
Wheelbarrows, Concrete Carts and Drag Scrapers

The Toledo Wheelbarrow Co.

Chicago Offices and Warehouse
337 River St., Chicago, Ill.

Toledo, Ohio

A Model Gravel Washing Plant at South Bend, Ind.

On this page is shown a modern gravel washing and conveying plant near South Bend, Ind., operated by the George J. Hoffman Company, having a capacity of five hundred yards a day.

Briefly the operation of the gravel pit is as follows: The cars, after being loaded by the steam shovel, are pushed by the engine up a small incline to a trestle built over a bin with a hopper bottom. The gravel



dumped into this bin is fed onto a belt conveyor, 300 feet long, 24 inches wide, which conveys it to a revolving screen. This conveyor, as well as the engine, screen, elevator and crusher, are equipped with Sawyer stitched canvas belts. Passing through the screen, the large boulders are removed from the gravel and fall into a gyratory stone crusher, the crushed material being delivered again to the belt.

The gravel and crushed boulders passing through the holes of the screen are fed through a bin and hopper to another belt which conveys the material up to the washing plant. This plant has two conical, revolving screens of the Dull type and delivers clean sand and gravel in three sizes into the bins below, ready for shipment.

From the washing plant the gravel and sand is loaded by chutes into Hart convertible cars of the Chicago, Lake Shore and South Send Railway, each car holding about thirty cubic yards of material.

The Hoffman company operate their own standard gauge locomotive, twenty ton, Vulcan type; one-yard steam shovel; western dump cars, etc., together with wagons and motor trucks for local delivery. Their washing plant is operated by an oil engine manufactured by the Saint Mary's Engine Company, St. Charles, Mo.

L. J. Hewes Appointed Manager Chicago Office of Traylor Engineering & Mfg. Co.

The Traylor Engineering & Mfg. Co., manufacturers of crushing rolls, gyratory and jaw crushers, Allentown, Pa., announce that they have opened a Chicago office at 1414 Fisher Bldg., in charge of Mr. L. J. Hewes, formerly representative of Power & Mining Machinery Company.

Mr. Hewes has been intimately identified with the stone crushing machinery business of the mid-west for the past thirty-six years, first with the old Gates Iron Works and then with their successors, the Allis-Chalmers Company, until he went to the Power & Mining Machinery Company, some twelve years.

Southwestern Cement Show will Have Interesting Exhibits

An interesting addition to the list of attractions offered by the Southwestern Concrete Association for its convention and show in Kansas City, February 19th to 24th, is the exhibit that will be participated in by the architects of the city. The Kansas City Chapter of American Institute of Architects has decided to co-operate in the show by placing on the floor of Convention Hall a large, comprehensive display of the work of local architects.

Another interesting joint exhibit will be that of the Portland Cement Companies operating in the Central West. These companies will occupy one end of the big hall and have their plans made to fill their space with something distinctly worth while. Several thousand dollars will be spent on this joint exhibit. A costly model showing good roads construction, views illustrating the steps in the manufacture of cement specimens of concrete work and displays of like nature which will cover several hundred feet of floor space.

In addition to these participants, seventy-five individual exhibitors of sectional and national importance will bring to Kansas City the newest and most economical machinery and methods for use in making more and better concrete.

The show will be open to the public for the full six days. Starting Tuesday morning the sessions of the convention will invite the attendance of every cement user in striking distance of Kansas City. And striking distance may be illustrated by the fact that letters from association members as far away as western Texas and southern Arkansas indicate that concrete construction in districts as remote from Kansas City as these will be represented.

"Paper Sacks"

We desire to call attention to
our manufacture of

"All-Rope" Paper Sacks

For Cement, Plaster, Lime,
Sand, Etc.

They are known to be the very
best, and consequently the most
satisfactory "Paper" sack made.

Write us for samples and prices.
We will appreciate it.

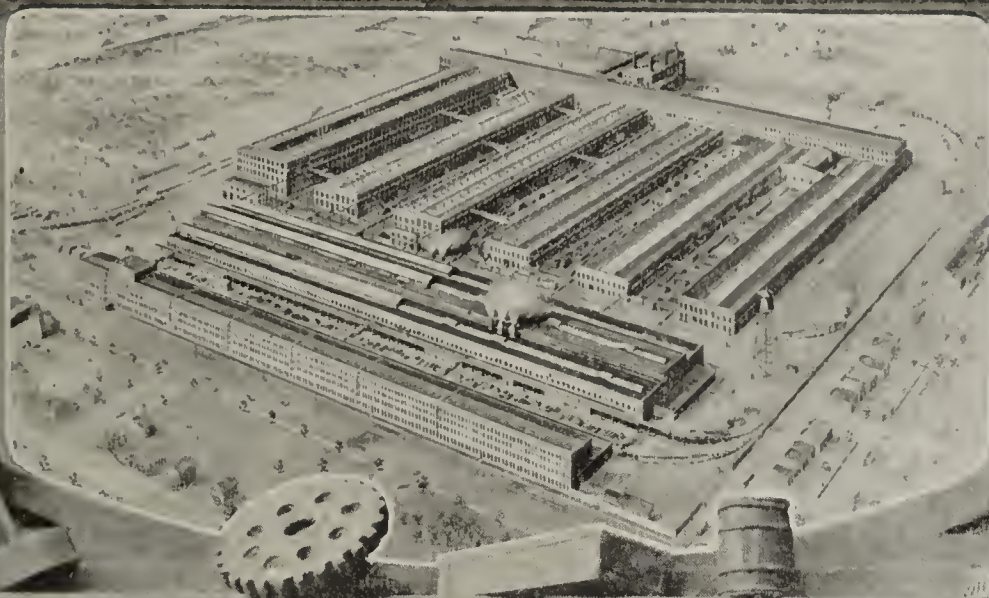
**The Chatfield & Woods
Sack Co.**

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Complete Cement Plants

WET OR DRY PROCESS

GATES BREAKERS
PRELIMINATORS
BALL-PEB MILLS
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KILNS
COOLERS
DRYERS
WASH MILLS
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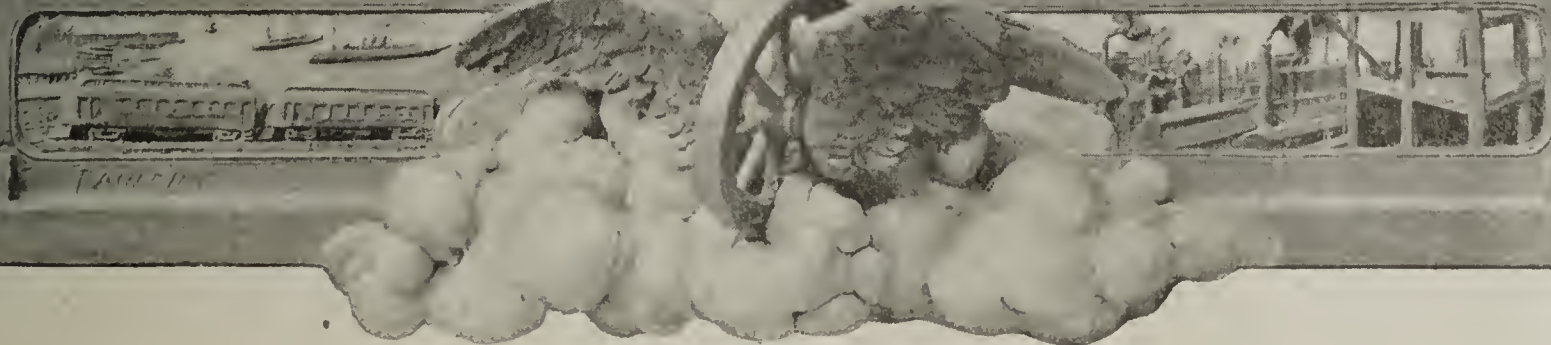
Allis-Chalmers Manufacturing Co.

MILWAUKEE

OFFICES IN PRINCIPAL CITIES

WISCONSIN

Refer all Canadian business to Canadian Allis-Chalmers Ltd., Toronto, Ont.



The Ideal Floor Sanding Machine

An electric floor sander, principally of steel construction, fitted with an automatic dust collector, and with a capacity of surfacing about 5,000 square feet once over in eight hours, has been marketed by the M. I. Schlueter Co., 225 West Illinois street, Chicago, Ill. The machine is equipped with standard motor, which may be detached conveniently and used for any other purpose when desired. Its construction allows for ease in operation and its efficiency makes the cost of maintenance low. An idea of its general construction is indicated in the cut herewith. It will be observed that such parts as ball bearings, chain and sprockets, etc.,



are covered with a shield to keep out the dirt and dust and to safeguard the operator from possible injury. The sand roller measures 8x15 inches, running on liberally proportioned ball bearings, and is directly connected to the motor by a silent chain drive. A patented feature of this machine is the self-adjustable provision made for holding either light or heavy paper without the use of packing. It is made to surface within 1½ to 2 inches from the wall, and closer work may be accomplished by the attachment of a smaller roller to either end of the larger roller. The frame of the machine is entirely of steel, and is therefore immune from cracking. At the back of the motor will be noticed an elbow. The suction fan operating as an automatic dust collector discharges all the dust into a large linen bag, which is properly connected to the elbow. On the handle an adjustable pressure regulating device is provided to control the amount of pressure on the roller for light and heavy cutting, and for rough and fine floors. Once the lever is adjusted the floor is assured of a uniform treatment. When the lever is pulled right back the roller is raised from the floor, permitting the replacement of sand paper on the roller. When in operation the machine has the natural tendency to move forward due to the revolving roller. By adjusting the lower lever on the handle a brake controls the speed of the machine. The company will be glad to furnish readers of Cement and Engineering News with particulars of its product and of its five-day free trial offer.

The Best and Most Comprehensive Library in Existence on Concrete, Etc.

Marshaling facts bearing directly upon the work in hand has come to be recognized as an important factor in modern business. No commercial, industrial or manufacturing organization today, if it be well equipped, is without its collection of books, pamphlets, periodicals, trade catalogs, reports, maps, etc., so administered that the material is available for any member of the organization at a moment's notice. Execu-

tives feel the need of a business library to keep every member of their organization informed of the latest developments in their particular industry and to aid them in research work tending toward more efficient production.

Cement manufacturers in the United States and Canada are leaders in thus marshaling facts pertaining to their industry. The library of the Portland Cement Association—which embraces the leading cement manufacturers—is a veritable mine of knowledge on this subject. More than 2,500 volumes are in the files. Engineers, contractors or any one interested in concrete construction will find there a storehouse of facts.

There is no red tape about securing any information that may be desired. One has only to call, write or telephone the library at 111 West Washington street, Chicago, and the information will be forthcoming.

It is in the fullest sense a business library. The books and pamphlets are selected very carefully. Before they are placed on shelves they are examined by a committee of experts so that the collection represents authoritative articles on cement, concrete and allied subjects. There is a very complete file of trade catalogs on machinery and materials used in concrete construction. The library also has a collection of complete building codes of cities having a population of 50,000 or over. About 150 current magazines are received every week.

The Portland Cement Association is particularly desirous that engineers, contractors or any persons interested in any way in concrete construction avail themselves of this authoritative source of information. It is free to all.

Do You Understand Dairy Barn Cement Work. Write for This Book.

Hunt, Helm, Ferris & Co., 67 Hunt St., Harvard, Ill., have just issued an interesting work entitled "Barn Plans and Dairy Barn Cement Work," containing a wealth of practical, usable, everyday information that you can't afford to be without. A copy will be mailed free to readers of Cement and Engineering News.



With the use of their "Star Adjustable Curb Clamps," cement work can be laid independent of the stall equipment. When the concrete work is finished the setting of the stall is merely a matter of clamping the stalls in place. Stalls can be put up or taken down in sixty seconds.

The drafting department of Hunt, Helm, Ferris & Co. is at the service of their contractor friends. They furnish special blue prints for your customers at no cost to you.



Concrete Flower Boxes.

Ornamental Concrete

A Line of Concrete Work for which there is a Rapidly Growing Demand.

The durability of concrete, the ease with which it can be handled in the process of manufacture, the adaptability with which it lends itself to any design, the superb finishes that can be developed with it and its relatively low cost as compared to other materials are the factors that are rapidly gaining recognition for concrete as the best available material for ornamental work. The importance of ornamental concrete work as a tremendously profitable line, is making substantial gains every day among cement and concrete products manufacturers and others connected with the industry.

Not only has the day of the cast iron deer and other animals as suitable lawn ornaments passed, but our esthetic sense has been tremendously developed as regards the beautification and decoration of our gardens, lawns and homes.

Outside of the distinctly millionaire class, to the majority of us, marble and other natural stones are quite beyond our financial reach. And this is just where concrete is filling a distinct requirement and at the same time, is piling up very substantial profits for cement and concrete men.

The great increase in the popularity of ornamental concrete is due to the efforts of mold manufacturers towards simplifying the necessary moulds and at the same time elaborating on the designs and decorative schemes for the products produced.

The lines possible in molded ornamental concrete include lawn vases, flower and small tree boxes, pedestals, sun dials, pergola columns and many other items, all of which in their proper place and in proper surroundings, give a charm to a garden scheme or lawn that cannot be otherwise duplicated.

It requires no special canvass or investigation of your city, town or locality, Mr. Concrete Man, to show you sales and profits if you put in a line of ornamental concrete moulds which will produce designs of real classic merit and beauty. Every home owner in your locality is a most excellent sales prospect. If your

ornamental concrete work is of good design and well finished, it will practically sell itself. The two flower boxes illustrated above, are remarkably good examples of the work being done along these lines. Either would make an instantaneous appeal to any home owner who had shrubbery, small trees or the larger plants to look after.

The sun dial is another item that can be very successfully produced in concrete and which is making wonderful strides in popularity. A very good design along these lines is shown herewith. Aside from the beauty and charm it gives to a garden or lawn, the sun dial is useful for the purpose for which it was originally devised.

The sun dial is quite commonly looked upon as a contrivance consisting of a plate with inscriptions marked, which by the shadow of the Gnomon may or may not show the correct time of the day. This is but one instance where justice is not given the subject. Maurice Maeterlinck pays a high tribute to the sun dial. In his chapter on "The Measure of Hours" from his "Life and Flowers" he has written: "The sundial alone is worthy to measure the splendor of the months of green and gold."

The sun dial when properly adjusted to your geographical location, will be found exceedingly useful and it has a hidden charm which no other garden ornament possesses.

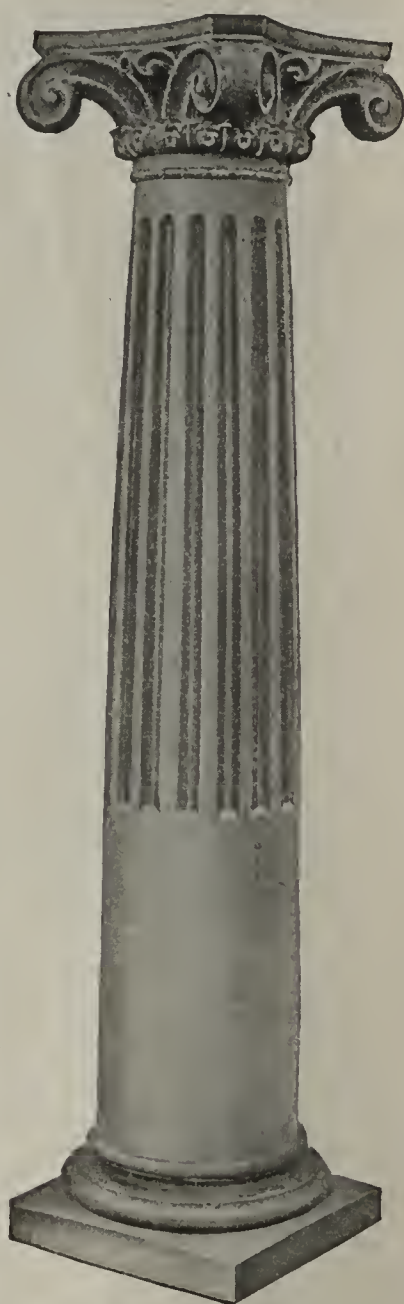
It is accurate in its marking of time, provided it has been properly adjusted, and you can at any time regulate your clock by its sharp shadow line.

The pergola and vine covered porches are other means of beautifying homes and grounds that have made tremendous progress in the past few years. To such a decorative scheme, concrete columns better serve the purpose than anything else. Not only are concrete columns graceful and artistic, but they are far superior to the ordinary wooden column in endurance and weather-resisting qualities. Full grown vines



ORNAMENTAL CONCRETE
PRODUCTS.

The molds for making these products are
made by the Ideal Concrete Mchy. Co., 1353
Monmouth avenue, Cincinnati, Ohio.



never have to be practically destroyed by the necessity of replacing the concrete supporting columns of arbors and pergolas.

We unhesitatingly recommend ornamental concrete as a very satisfactory and profitable line for concrete products manufacturers, cement and concrete men, provided they equip themselves not only with moulds that will produce work of real artistic merit and beauty, but the well made mould that turns out a



mechanically true product. Such equipment is manufactured by the Ideal Concrete Machinery Co., 1353 Monmouth avenue, Cincinnati, O. Their new Catalog No. 13 illustrates ornamental and special moulds for concrete products. Send for a copy.

We make these specifications for the reason that it is our belief that concrete and concrete products have many times been seriously hurt by horrible, inartistic examples of ornamental concrete work. We see this in



so many instances with the concrete building block through the effort to imitate natural rock, etc.

Imitation is said to be the sincerest flattery and this applies just as much in concrete as with anything else. It is an admission of inferiority which no good concrete man should be willing to admit. Further, it is a cardinal principle in architecture, with which ornamental concrete is very closely allied, that one material should never be used to imitate another material. If wood is the best means of expression for a certain purpose, wood should be used. If concrete will express the designer's idea, concrete should be used. It would, therefore, seem that the objective of the cement and concrete men, not to say the entire industry, should be to make concrete beautiful as concrete. Especially, concrete is progressing rapidly, but at the present time

its highest esthetic development is in ornamental work. No quicker way can be found for adding to concrete's popularity than well made, well finished ornamental work of good design.

The process of manufacture of ornamental concrete is not unlike any other class of concrete products. Care has to be exercised at all times, perhaps a little more care than with most ordinary products. A "three to one" mix produces the best results.

As to selling the product, as was noted in this article, good, well made ornamental concrete work will sell itself. Still, there are various good methods of forcing sales. A concrete man making a line of ornamental concrete box for shrubbery and the larger plants, of whom the writer heard, secured the larger part of his sales for this one item of ornamental concrete that he was making, through an arrangement with the florists of his city. By furnishing the florists with sample boxes in which were displayed bay trees, box trees and other similar plants and trees, in the majority of cases when sales of trees were made a sale of the ornamental concrete box was made at the same time. A small percentage or commission was allowed the florists on each sale.

Again, if you are looking about for a good profitable side line, we recommend ornamental concrete. It does not require a large initial investment, but it pays big profits. Since it is the profits you are looking for,



study the ornamental concrete "game," look over your field. Your investigation will show you enough to warrant early action.

Lawn vases, flower and tree boxes, pedestals, sun dials and pergolas are the vogue. Concrete is the material.

Power Scrapers

Sauerman Brothers, engineers, dealers and manufacturers of cableway excavators and power scrapers, 1139 Monadnock Block, Chicago, Ill., have just issued a catalogue illustrating and describing the Sauerman power scraper, of which there are a large number in use in various parts of the country. By a generous use of sketches and cuts the members of this firm have endeavored to make it possible for anyone to have a very good knowledge of the work that can be done with the scrapers and how they should be installed in order to secure the best results.

CEMENT AND ENGINEERING NEWS

(PUBLISHED MONTHLY)

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Advertising copy or changes in ads. must be in this office by the 25th of each month, as hereafter our magazine will appear on the 5th of the following month

Advertising Rates Sent on Application

JOHN F. WALDRON

Advertising Manager

CHICAGO, MARCH, 1917

The Cement Show

When Germany obtained Helgoland from Great Britain the mighty rock was disintegrating. That is one reason why England let it go. There were big fissures down the face of it. Under the action of sea erosion it was crumbling. It had not occurred to the British that there was a method of saving it and making it eternal.

But it occurred to the Germans. They filled up the cracks and fissures with concrete; they refaced the eroded, spongy surface; they made Helgoland as hard as iron. They made it better than iron, because iron rusts.

And Helgoland stands today the invincible guardian of the mouth of the Elbe, the Kiel Canal, Wilhelmshaven and the German navy.

That is a "concrete example." There were many more of them at the cement show recently held in the Coliseum at Chicago. What was good for Helgoland is good for a thousand other purposes—domestic, commercial, national. Cement is a factor in preparedness, an indispensable material in modern fortifications, gun emplacements and other necessary work.

Cement is now one of the giant industries of America, along with steel, automobiles and the films. The cement show was a revelation in its disclosure of what this material means to the modern world. It is a chapter in the history of world building that no intelligent citizen should ever miss.

Government May Require Recovery of Potash from Cement Dust

If the experts of the Bureau of Soils of the Department of Agriculture have their way about it, every cement manufactory in the country will use an electrical precipitator to obtain potash from the flue dust which now escapes into the air, a nuisance instead of a benefit. The bureau is particularly interested in the matter because of its desire to see a sufficient quantity of potash produced in the United States every year to meet all the demands for potash salts for fertilizers and other needs, in other words, to make the

United States independent of any foreign supply of potash.

The bureau is proceeding rapidly with its investigation of samples of all products of practically all the large cement factories in the country. Investigation at a number of plants shows that a large amount of potash might be obtained as a by-product of cement manufacture, making almost a clear gain for the cement manufacturers. It is believed here that if all the factories can be prevailed upon to install electrical precipitators, a very large percentage of the potash required in this country each year may be obtained.

Block Men Must Get License

"This is the season when manufacturers of cement or concrete blocks begin preparing for their year's work," says recent number of the weekly bulletin of the Detroit department of buildings. "To these persons the department wishes to make known that new licenses will be required for all who manufacture and sell blocks within the city of Detroit.

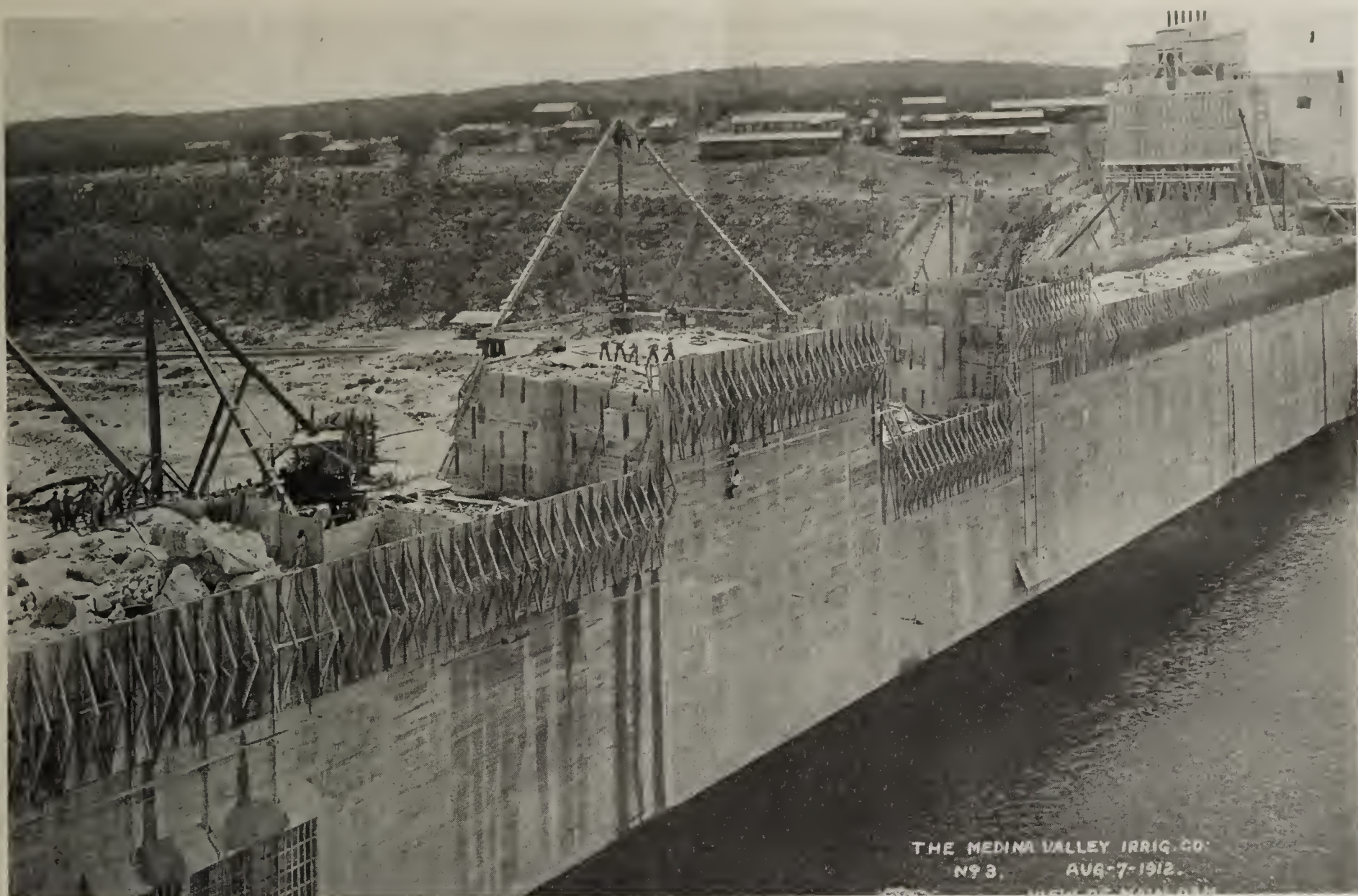
"To be able to secure a license to manufacture blocks, the manufacturer must submit his product to a test, to ascertain the crushing strength the block will withstand. The blocks must be capable of standing a crushing test of 1,500 pounds for square inch, and in case more than one test is made, no test shall be less than 1,000 pounds for square inch.

"The manufacturer is required to make a batch of blocks, and after proper aging, place them on the job where they are to be used, whereupon any block so placed is subject to selection for a test by an inspector from this department. If the block stands the required test a certificate of license will be issued by the department of buildings. All manufacturers are required to file a copy of the brand or trade-mark they will stamp upon their blocks, so inspectors of the department may know that no unlicensed blocks are being used in construction work. No blocks will be accepted by this department unless properly branded."

Model Concrete Road Opened

Unusual ceremonies marked the opening of the reconstructed section of Pennsylvania State Highway No. 159, or the Easton-Allentown Road, as it is more generally known, on January 30th. The William Penn Highway Association which had the opening ceremonies in charge set a record for "good road openings." Charles M. Schwab, Chairman of the Executive Committee of the Bethlehem Steel Company, was chairman of the ceremonies for the day. Governor Martin G. Brumbaugh, accompanied by his staff, assisted in the exercises. Special trains from New York, Philadelphia and Harrisburg carried more than 7,000 guests to Easton, from which town automobiles took them on an inspection tour of the completed portion of the highway.

The section of road formally opened is a reinforced concrete section built under specifications prepared by Chief Engineer W. D. Uhler of the State Highway Department and supervised by J. E. Sampson and W. R. Wolfinger, engineers with State Highway District No. 5. The section, which is of standard width of 16 feet throughout, is part of the through arterial route system of Pennsylvania. Notwithstanding the unusual opening ceremonies, this road is merely typical of the concrete road adopted as standard by the Pennsylvania Highway Department.



View of Main Dam, Looking Downstream. Height of Dam, 180 ft.; Crest Length, 1,580 ft. Concrete Made of Crushed Stone and Cement; No Sand Used.

The Medina Valley Dam

By TERRELL BARTLETT, Engineer in Charge.

The main concrete dam of Medina Valley irrigation project in Texas may be seen in the accompanying photograph. The great dam recently completed near San Antonio, Texas, is 164 feet high and contains nearly 300,000 cubic yards of concrete.

This irrigation project is based upon the storage of the flood waters of the upper Medina River by means of the main dam, which is located at the head of the canon through which the stream emerges from a region of rugged limestone hills onto the rolling coastal plains of southeastern Texas.

The lands to be irrigated lie in a solid body of 60,000 acres in the plain country at a distance of from 20 to 30 miles from the main dam. The lands are remarkable for their fertility, are well drained, and have exceptional transportation facilities, lying along and between two trunk-line railways.

The water is conducted from the main dam to the lands first in the natural river bed for the four miles of canon, which will be converted into a narrow lake by means of a secondary or diversion dam. This structure is 50 feet high and turns the water into the canal head. From this point the main canal extends 24 miles to the head of the distributing system.

An annual feature of the project is the enormous storage of the main reservoir, which has a maximum capacity of 300,000 acre feet. This large storage was considered advisable on account of the torrential nature of the stream, and it will make possible the conservation of a large percentage of the run-off from the Medina Basin.

In size of construction the main concrete dam is nearly 90 per cent of that of the famous Roosevelt

Dam near Phoenix, Ariz. The Medina Dam is 164 feet high above the river-bed, and from the bottom of the cut-off trench to the top of the concrete has a total height of 180 feet. The crest length of the dam is 1,580 feet, the base width is 128 feet, and the crest width is 25 feet.

The foundation is in the massive level-bedded limestones, which form the canon walls and all the hills of the region. The spillway, 1,200 feet long, is over a saddle into an adjoining ravine. The dam-site is about 14 miles by air-line from Dunlay, the nearest point on the Southern Pacific Ry.

As soon as the bonds for the project were sold, excavation for the foundation was immediately commenced, and material for camp buildings, machinery foundations, etc., was hauled in by a new wagon road from Dunlay. At the same time construction was rushed on a standard gage railway from Dunlay to the dam.

On account of the rough character of the country this line is $19\frac{1}{2}$ miles long, with sharp curves and grades of 3 per cent against the traffic and $3\frac{1}{2}$ per cent against the returning empties. While this railway was in process of construction, the excavation and lighter preliminary construction, as well as the opening of quarries, was going forward at the dam-site, and simultaneously all the machinery was assembled and heavy timbering was framed at Dunlay.

In the construction of the project the railroad was completed the latter part of September, and the plant was erected within sixty days after, a really remarkable performance when the unusual magnitude of the plant and its isolation are considered. The materials for making the concrete were all secured at the site

with the exception of the cement. The quarries are in a very hard, cherty, semi-crystalline limestone quartz, sand of a mediocre quality could have been delivered over the railway for about \$1.40 per cubic yard, but it would have been very difficult to handle the large quantity of sand over the single track, steep-grade road.

Accordingly, the fines and dust from the first crushing of the limestone, together with dust from special pulverizing crushers, were utilized for sand throughout the dam. The cement used came principally from the mills of three cement companies, located in the State of Texas, making as short a haul as possible.

The mixture of concrete used was 1 cement to $3\frac{1}{2}$ limestone dust and fines to $6\frac{1}{2}$ stone. This required slightly over 1 barrel of cement per cubic yard. Daily tests of cubes and of short, plain beams showed strength of great uniformity, greater than many first-class concretes of 1:3:6 mix. After the dam had reached a height above the zones of heaviest pressures, it was, therefore, deemed justifiable to decrease the percentage of cement.

Test specimens with a smaller proportion of cement showed a much greater strength than usual in such mass construction, as well as a high degree of imperviousness. However, when this decrease was tried in the dam it was found to be detrimental to the plasticity of the concrete, and its ease in working, and on this account the attempted economy was abandoned and the original proportion used for the entire dam. Rubble stones up to ten tons weight were imbedded in the concrete. At the bottom, from 10 to 15 per cent of the mass consisted of these stones, but toward the top the percentage gradually decreased. The percentage for the entire dam was 0.9 per cent. A larger percentage would have effected a cost saving in the items of cement, crushing and mixing, but would have delayed the rapid progress and thus overbalanced the saving by the loss in overhead expense and interest charges.

The contractor's concrete plant was located on the west bluff, which was dictated by the railway location, which necessarily came in on that side. Adjacent to the end of the railway on one side were the store rooms and the commissary, and opposite were the shops and lumber yards. A spur track on a trestle was carried out over the boiler plant and over the center of the cement shed, enabling unloading of fuel oil and cement by gravity. Power was derived from seven 150-h.p. boilers, with steam lines to the various engine locations. Only the small engine for lighting and the compressors were located at the steam plant.

It must be noted that the principal quarries were located above the dam on the plant side, the furthest at a distance of 2,000 feet. A third quarry exclusively for the large stones was located in the east bluff below the dam. Skips of stone from the main quarries were handled by three standard gauge locomotive cranes onto 4-yard dump cars. The latter were hauled by four dinkies around a loop track to the crushers.

In this construction work the crushers used were two gyratories located immediately back of the combined mixer bin and screen house. Bucket conveyors took the crusher run stone to the screens above the stone and sand bins. The desired percentage of medium sized stone was returned to two Symons disc crushers and two Williams pulverizers for making the sand.

Under the bins was a mixing deck with five hoppers served by radial cutoff gates from the stone bins, and automatic measuring chutes for sand. Cement was delivered to this deck by a belt conveyor from the adjacent shed. On the next deck below was a battery of five 1-yard batch mixers emptying into hoppers.

The crushers, conveyors, sand machines, shafting and driving engines for this machinery, as well as for the mixers, was a complete double installation.

On still a third level below was a narrow gauge track on which flat cars carried the concrete buckets about 75 feet to the cableways. This method of delivery was used exclusively for the narrow upper portion of the dam. For the principal mass of the dam delivery was almost entirely by inclined chutes leading from the discharge hoppers down the face of the bluff into a large wooden hopper located over the end of a double-track incline, which extended from bluff to bluff, first along the downstream edge of the dam, and later a high level on the face of the dam.

For conveying the material two cableways were used with $2\frac{1}{4}$ -inch cables of spans of 1,050 and 1,270 feet, their load capacity being ten tons. A car carrying two 2-yard buckets or 4 yards per trip was used on each incline track, so that it was possible to send 8 cubic yards at once to the various derricks by the incline, as well as 2 yards simultaneously by each of the cables. The phenomenal progress records were made possible, first, by the adequacy of the crushing and mixing plant, second, by the triple system of hoppers by means of which the materials were always ready and waiting for the buckets, and, third, by the incline, with its enormous and rapid delivery capacity. The limiting speed condition was in the quarry output.

"Stonekote" Stucco Exteriors

Everyone admires beautiful texture of stucco exteriors, but there are some kinds of stucco which seem to present a better appearance than others. The buildings covered with "Stonekote" stucco, made by the Garden City Sand Company not only appear more beautiful at the start, but they keep their good appearance indefinitely.

Stonekote is a cement plaster for all exterior surfaces with rough cast, float coat, trowel finish or polish finish. It is hard as natural stone and is made in any non-fading colored desired. Stonekote is an impervious and durable cover for buildings. The composition of Stonekote is such that it admits of the most beautiful and artistic variation of color and finish. The re-



Stonekote Residence in Oak Park, Ill.

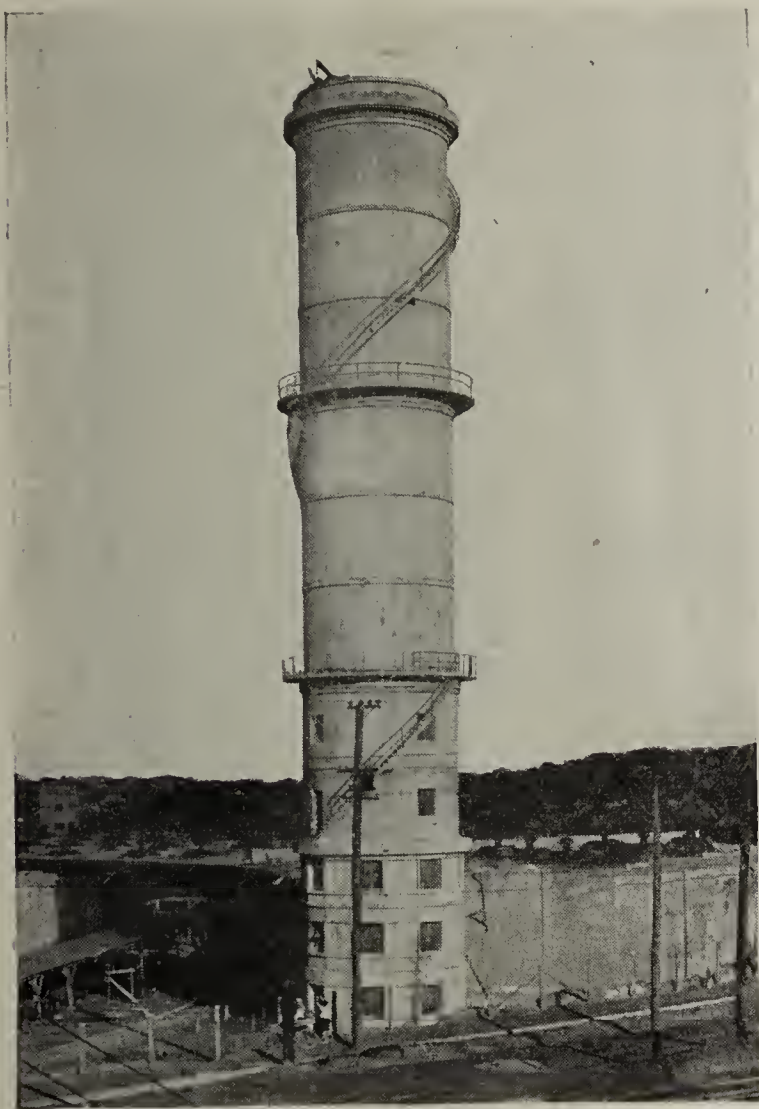
productions of photographs which we show herewith will indicate the value of Stonekote for most old and new buildings and the manufacturers advise us that they will be glad to send our readers their booklet, which will tell how one can make more money by using this wonderful stucco on their buildings or on any old ones which they are overcoating.

Stonekote is shipped as a dry material; any mechanic can mix and apply. It is the only perfect waterproof and wear-resisting plastic finish to give permanent and delightful results. Cement & Engineering News, 672 Transportation Bldg., Chicago, will be glad to send you booklet and samples.

Ferro-Concrete Tower and Tank

An interesting example of a reinforced concrete water tower and tank is that constructed for the Atlanta Warehouse Co., Atlanta, Ga., by Arthur Tufts, contracting engineer, after design by E. A. Stuhrman. The water tower is intended to supply the necessary pressure for a sprinkler service for these immense warehouses.

The entire structure is 142 feet 6 inches from the ground line to the top of the cresting, with inside measurements of 22 feet 6 inches in diameter. Features of especial prominence are the fact that the lower portion of the structure is subdivided so as to form three tower offices on separate floors. Also, observation stairway leading to the different landings and top of the tower is provided, and lastly, that the water supply of 200,000 gallons is divided and taken care of in two separate compartments of the reinforced concrete tank. The height of the lower dome above ground



level was determined by a rule of the Southeastern Underwriters' Association for the maximum elevation of water above the highest sprinkler in the adjacent warehouse at 35 feet. This brings the lower dome approximately 55 feet from the ground level. Under the same requirement it was necessary to provide for a total storage capacity for fire extinguishing purposes of 200,000 gallons. Preliminary studies demonstrated that the greatest economy of construction would be derived by dividing the tower into two superimposed tanks of equal capacity.

The diameter of the tank was arbitrarily fixed by esthetic consideration, with some thought to practical elements and economy, especially in the matter of design of the dome bottoms.

In designing these, while the form of curve shown is that of a circular segment, the rise was determined somewhat by the rise given for the theoretical hydrostatic arch.

The formulas used in arriving at the height of this

arch were those deduced by Professor Rankin for the hydrostatic linear arch.

As the height of arch was determined, the stresses in the dome were found by the ordinary methods used for the elastic arch and its application to dome designing.

Theoretically, it is not necessary to reinforce the dome bottom, since the outer circumferential ring of reinforcement can be relied upon to care for the thrust of the dome. However, for practical reasons, it was deemed expedient to place a small percentage of steel reinforcement.

To insure water-tight properties, at what might be called the "panel points" in the tank, an 18-inch band of perforated steel lapped at intervals was used. These bands or panel points were 13 feet 4 inches apart, and all of the material in these sections was placed at one pouring.

The concrete mixture was one of cement, and one-half of especially sharp, graded sand and three parts of clean gravel, with 5 per cent hydrated lime in the mix. At each of these panel points, too, there were constructed brackets for the two points of support of the spiral stairway, made also of reinforced concrete. The total amount of material in this tank and tower was 595 cubic yards of concrete, 159 pounds of steel. The entire cost of the structure was \$16,767.

The tank has been filled since July, and shows no leak or other defect.

The warehouses which the water tower is expected to protect range in height from one to three stories. All buildings are to be concrete and occupy a space of over 20 acres within the city limits, and are served by every railroad entering into Atlanta. The water supply for fire protection and domestic purposes is obtained from the city mains, and a "dry pipe" sprinkler system is installed, together with 60 automatic fire boxes. The rate secured under special risk from the underwriters is the lowest known for fire insurance.

The warehouses were built to handle and compress cotton, but they are also designed so as to care for any and all classes of merchandise, receipts for which, when issued by the Warehouse Company, are negotiable at all banking-houses. The entire cost of the ground, buildings and equipment will exceed \$1,000,000.

Larger San Francisco Office for Williams Co.

The Williams Patent Crusher & Pulverizer Co. of St. Louis, Mo., have taken larger quarters for their Pacific coast sales office, at 67 Second street, San Francisco.

The San Francisco office, which has been in charge of Mr. O. J. Williams for a number of years, has developed a very satisfactory trade among the ranchers, for the Williams alfalfa grinder, as well as in the many other fields in which the Williams mill is used.

The new quarters are larger and more centrally located and are connected with a warehouse in which the Williams company maintains a complete stock of spare parts for different types of their grinders. This makes it possible to supply parts promptly to customers who are far removed from the main office.

The increased business of the Williams company is not directly traceable to war contracts. However, the manufacturing of many materials in this country which were formerly imported from the nations now at war has opened up new fields for the Williams mill.



Fig. 4. Side and Rear, Concrete Section House, Lehigh Valley R. R.

Tile and Cement Section Houses

The Lehigh Valley Railroad has erected, at Flemington Junction, N. J., some dwelling houses of pleasing design for section foremen and laborers. The buildings consist of cement-plastered hollow tile walls, on concrete foundation, with concrete floors and asbestos shingle roof.

The plans of the cellar, first and second floors are shown in Fig. 2. Each of these buildings is roughly, 33x34 feet, with a 20x25 ft. cellar, the remaining space being filled. It will be noticed that the first floor is of concrete, 4 ins. thick, on 2x10-in. joists. The porch floor is a 5-in. concrete slab, resting upon beams of old rail.

The first floor is divided into three rooms, namely a 12x15-ft. dining room, a 12x18-ft. kitchen and a

14x30-ft. bunk room. On the second floor there are three rooms, one 12x15 ft., another 12x11 ft., and another of irregular shape, 8x9 in the largest dimensions, the remainder of the space on this floor being in the attic. The buildings are sanitary throughout, and pleasing and neat in appearance, exterior views being shown in Figs. 1 and 4.

Location for Cement Products Business

Hawkins Sand Company of Marshalltown, Iowa, write that they would be glad to communicate with parties who would be interested in a location for a cement products business.



Fig. 1. Front of Concrete Section House, Lehigh Valley R. R.

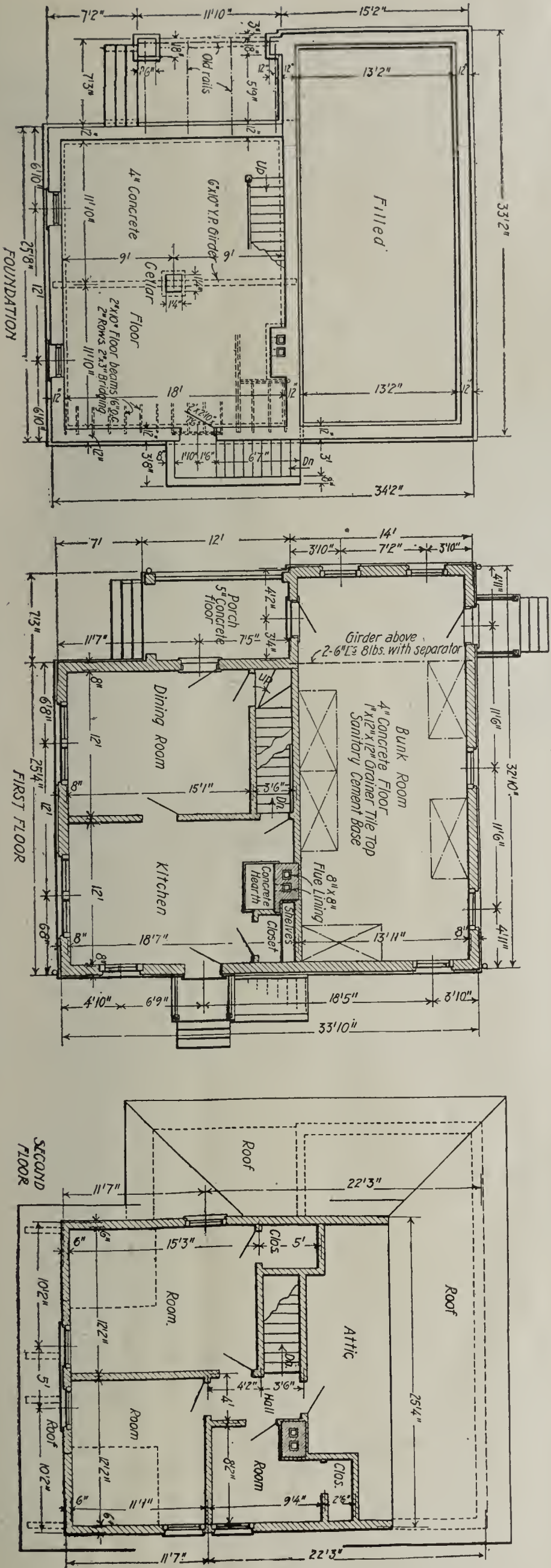
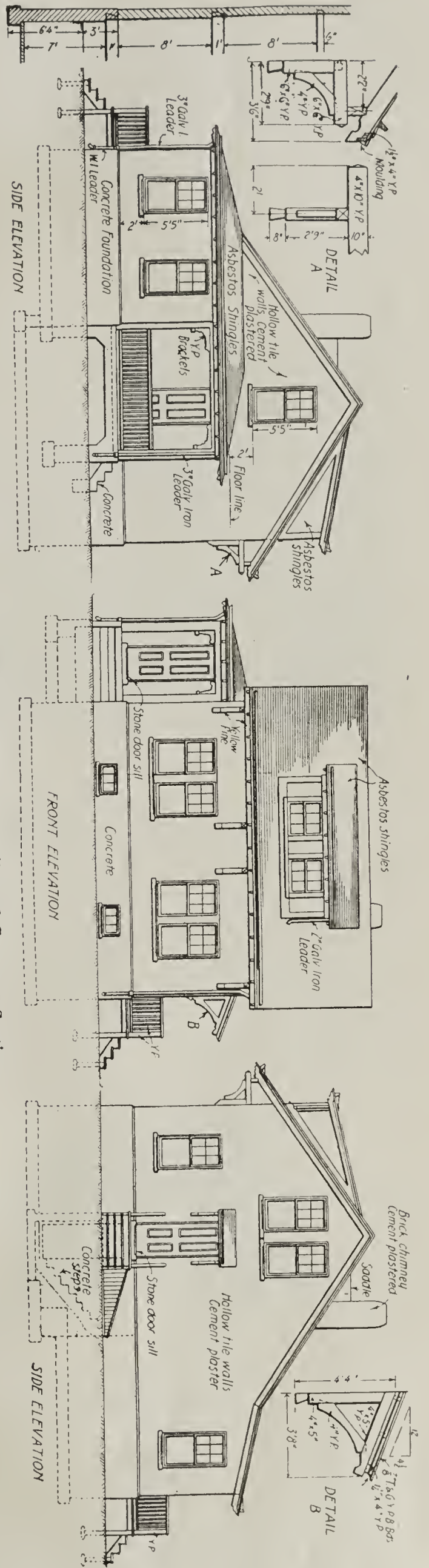


Fig. 2. Basement and Floor Plans of Tile and Concrete Section Houses, Lehigh Valley R. R.

Fig. 3. Front and Side Elevations of Tile and Concrete Section Houses, Lehigh Valley R. R.



The Advantages of a Small Mixer

The foundation, particularly the small foundation, is often a source of annoyance. Small contractors feel that their requirements are hardly sufficient to make a Mixer pay, while large contractors who often run into a small job do not like to haul their large Mixer on such a job and put it into operation where there is so little concrete to be poured.

This condition has created a field for the IDEAL Cincinnati No. 5 Batch Mixer, manufactured by the Ideal Concrete Machinery Co., 1353 Monmouth ave-

because a large loading platform has been built on so that the materials can be wheeled directly on to the platform and discharged into the Mixer from the wheelbarrows. The platform is large enough to permit a man with a wheelbarrow to turn around on same or to accommodate a water-barrel or some sacks of cement. The two-wheel outfit is fitted with standard gauge trucks and can be hauled behind a wagon over the rough roads.

Contractors who are using this Mixer say that they get out more concrete at a mixing expense of approxi-



Small Ideal Mixer on the Job.

nue, Cincinnati, Ohio, which is manufactured both as a two-wheel outfit with loading platform built on, and as a four-wheel outfit (see illustrations). The capacity of this Mixer is 5 cu. ft. dry materials, which requires just one-half sack of cement to the batch.

This is just the right size for handling small work for while this Mixer will mix 45 to 50 cu. yards of concrete in an ordinary day's run (far more than is required for the average foundation job), still it is small enough and light enough to be conveniently handled, so that it is easily hauled from one job to another, or moved around on the job, in fact it is easily placed upon the forms, so that the concrete can be



Cincinnati Small 4-Wheel Batch Concrete Mixer.

discharged directly into the wall without any wheeling or shoveling.

Both the two and four-wheel outfits are of the low charging type and their construction throughout for strength and wearing qualities is fully equal to any of the large Mixers. The two-wheel outfit is especially recommended for handling foundation work or similar jobs. It is well adapted for this kind of work



Cincinnati 2-Wheel Outfit, 5 Cubic Feet Capacity.

mately 50 cents a day than they formerly could using a gang of five or six men at an expense of \$12.00 to \$15.00 daily and at the same time they get a more uniform and thoroughly mixed product.

This Mixer is also coming into favor for large contracting jobs, as it is more economical in some instances to place these small Mixers around on the job and mix the concrete at the spot where it is to be placed than to have a large mixing plant and a complex distributing system.

In constructing Cincinnati's Speedway last summer Contractor Ed. Ryan effected a great saving in pouring the 8,000 concrete supporting columns for the Race Track by using three IDEAL Cincinnati Mixers No. 5.

The big Mixer is extensively advertised and contractors have for years been educated into its use, but of late years they are laying aside their prejudice against the small Mixers and find that they do thorough work at a lower mixing cost because practically each part of the job is handled as a separate unit and works independently of the rest, whereas a mixing plant for the job as a whole must be operated even when a small slab is being poured in a far off corner. Furthermore contractors find that the erection and manipulation of a distributing system necessary for a central mixing plant is a burden and expense that can be eliminated on a great many jobs.

Concrete Chimney

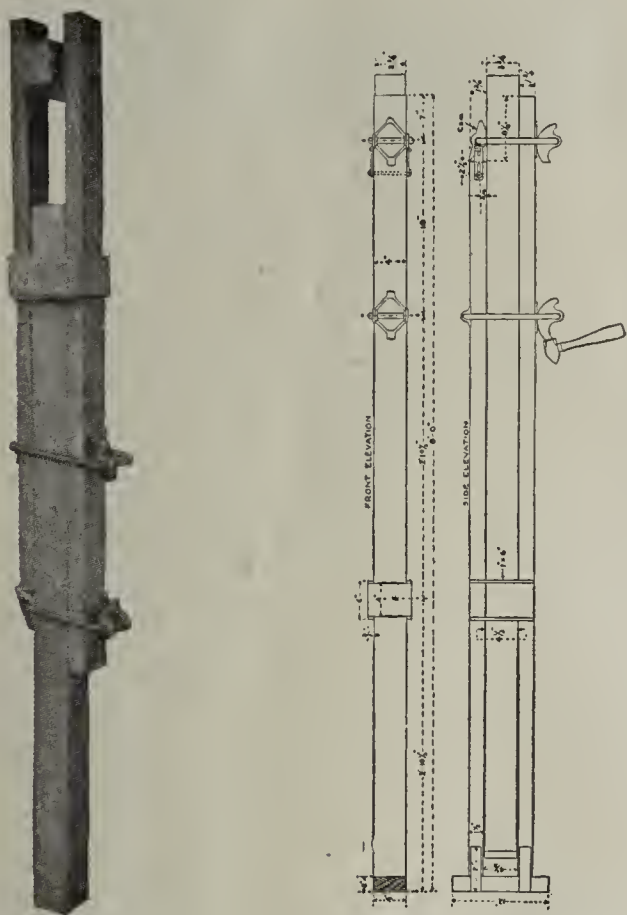
What is said to be the highest smokestack in Illinois has just been completed by the Wiederholt Construction Co. of St. Louis for the St. Louis Smelting and Refining Co. at Collinsville, Ill. It is 375 feet high, has a diameter of 44 feet at the base and tapers to about 17 feet at the top.

An Adjustable Shore for Concrete Form Work

An adjustable shore developed recently by Mr. Hodges, one of the superintendents of the Ferro Concrete Construction Co. of Cincinnati, O., has enabled the company to make very material decreases in its concrete form costs. These shores are used to hold up beam forms and floor forms, or in any other way that shores are ordinarily used on a concrete building job.

The construction of this new adjustable shore is simple. Three pieces of lumber are required. Experience and tests have proven that the following dimensions are the most satisfactory and if the shore is made from these dimensions it is even stronger than a rough 4 by 4 in. shore of the same length. The lumber should preferably be No. 1 common long leaf yellow pine, two 2 by 4s planed to $1\frac{3}{4}$ -in. and one 4 by 4 in. planed to $3\frac{3}{4}$ -in. by $3\frac{3}{4}$ -in. All three should be about 8 ft. long. In addition to this lumber, which is assembled in accordance with the illustration shown, two special clamps are necessary. These operate by a small blow of the hammer, and fasten the three timbers into a rigid non-collapsible member which can be nailed to or braced at any point desired. The shore is instantly adjustable from 8 to $14\frac{1}{2}$ ft.

The shore is sometimes made with a slotted head, and this type has certain advantages over the one shown in that it can be set up without any nailing



Adjustable Shore for Concrete Form Work.

or cleating whatever, and cannot fall down when struck or jarred. Neither type will collapse under load, as can be readily seen by studying the action of the cams.

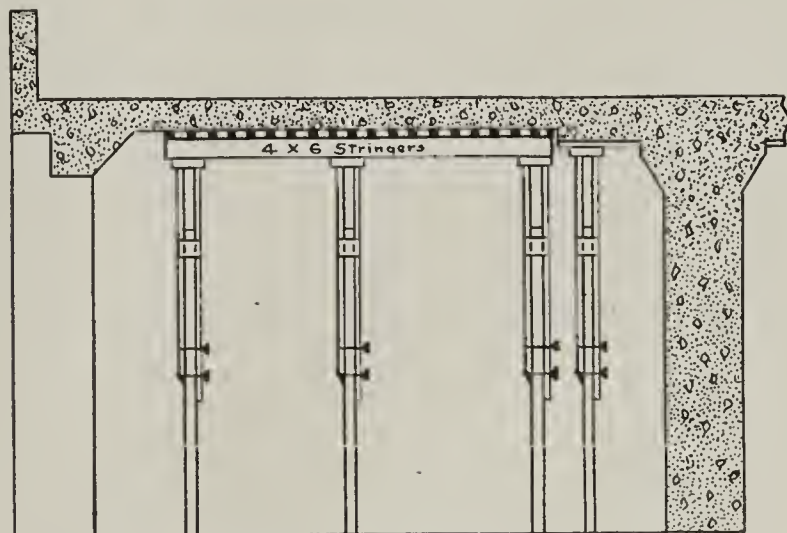
In operation the shores are brought from the storage pile and deposited wherever needed on the job. The clamps are loosened and the 4 by 4-in. timbers drawn out to the desired length, this being determined by a measuring pole in the usual manner. The clamps are then tightened, the shores are raised and the stringers placed in position. Intermediate shores can be put into place without careful measuring and after the decking is on, can be leveled up by means of an engineer's level and shore jack in a fraction of the time

which is usually required with wedges. With the Hodges shore wedges are unnecessary.

According to the experience of The Ferro Concrete Construction Co. in using these new shores, it seems that from 10 to 12 ct. can be saved on each shore every time it is used. Not only is there a saving in waste lumber, but on account of freight rates the actual cost of the lumber used in these shores is less than the cost of rough 4 by 4 stock for common shores.

Chief Engineer Crescent Cement Company

William M. Acheson has resigned as Division Engineer, New York State Highway Department, Division 6, to become Chief Engineer of the Crescent Portland Cement Co., Wampum, Penn. He was educated at Rensselaer Polytechnic Institute and Union University. He entered the employ of the Troy Water Works Department in 1900 as a chairman. Two years later he was placed in charge of construction of the Quackenkill diverting dam. In 1904 he joined the engineering staff of the Panama Canal as a leveler. Subsequently he was promoted to be Acting Resident Engineer in the Bureau of Municipal Engineering and Engineer in charge of the Third district of the Pacific division, which included the Bureaus of Municipal, Sanitary Engineering and Building Construction. He left the Canal Zone in 1910 to become Supervising Engineer of the County Construction Co. in New York State. In October, 1913, he was appointed Division Engineer, New York State Highway Department.



Hodge's Adjustable Shore Supporting Floor Forms.

Factory Manager of New Cement Mill in Peru

Mr. Stuart Smith, Engineering Chemist, sailed Feb. 24th on S. S. Pastores of the United Fruit Company for Lima, Peru, where he has accepted a position as factory manager for the Compania Pemana De Cemento Portland.

Superintendent Ft. Dodge Cement Company

Mr. Howard H. Leh has resigned his position as chemist with the Lehigh Portland Cement Company, Mason City, Iowa, to accept a position as superintendent and chemist for the Fort Dodge Portland Cement Corporation, Gilmore City, Iowa.

Air-Tight Silo Doors Necessary

Many silo builders are too apt to ignore a point in construction that is really vital for the success of their work, and that is, to install only doors that are air-tight and easy of manipulation. It is an acknowledged fact that the doors and door-frame of any form of silo construction form a vital part of the silo, inasmuch as the combination provides the seal upon which depends the exclusion of air from the ensilage, and thereby determines the keeping qualities of the silo—just as a thoroughly effective seal is necessary to the keeping of preserved fruit or canned vegetables. An absolutely air-tight and moisture-resisting wall may be provided in the construction of a silo—just as a perfect bottle, can, or other container may be provided in the canning of fruit or vegetables; but with a defective seal, these provisions are useless. The principle of canned corn applies throughout to ensiling the corn crop, and an air-tight seal is as necessary in the proper preservation of ensilage as in the keeping of canned fruit or vegetables.

Many concrete builders who are now erecting silos work hardship to the concrete business in general by an improper or at best an incomplete handling of this important feature, providing only a "hole in the wall" for doors and doorway, and leaving the farmer-buyer to provide some method of closing or sealing the silo. Left to his own resources, the farmer will oftentimes arrange some ineffective, impractical, and unsatisfactory means of sealing the ensilage and of ascending and entering the silo. A properly constructed door and door-frame, carrying with it a convenient, safe, and practical means of ascending the silo, built in the many concrete silos which are to be erected throughout the country this season, would result in thoroughly pleased users of these silos, and would immeasurably boost the silo industry. A neat, well-finished, workmanlike job will secure the payment of the bill by the farmer-buyer; but when in actual use, the inconvenience and impracticability of the makeshift door and door-frame—or no door at all, as provided by many builders—will injure the concrete silo business to a great extent in the community where such jobs are erected.

Adjustable Stalls for Concrete Barns

Farmers and dairymen who have been diffident about the use of concrete for barn floors will find a solution of their problem of adjusting stalls and stanchions in a simple little curb clamp, a new product of Hunt, Harris, Ferris & Co., 67 Hunt street, Harvard, Ill. See their advertisement elsewhere in this issue.

With the use of the Star curb clamp the trouble of setting up any of the stall equipment before the cement work is done is eliminated. It is not necessary to put anchors of any sort into the curb and removes the possibility of mistakes in setting the stalls. The curb can be finished with the rest of the concrete and the setting of the stalls afterward is merely a matter of setting them in place, dropping the clamp over the curb and tightening the draw bolts.

The clamp is very simple—just two malleable jaws adjustable to the curb by means of the draw bolts. Despite their rigid hold on the curb, they may be instantly removed. By leaving a continuous channel for ends of stall partitions, the stall may be placed where desired and then cemented in. Now it is up to the farmer to get busy with more concrete.

Silo Equipment for Many Uses

An extremely attractive proposition to those interested in concrete silo building, is that offered by the Polk Genung Polk Company, Fort Branch, Ind.

It is not necessary these days to argue the advantages of the concrete silo—cheap, serviceable, durable, storm-proof, fireproof, easily and quickly erected, and practically free from upkeep costs of painting, etc. These advantages are everywhere recognized. There are, however, many different commercial systems for working out the details of construction, and these it behooves the silo builder to consider and compare very carefully.



Monolithic Concrete
Silos Built with Polk Forms.

The Polk Genung Polk Company make a specialty of easily handled steel forms for concrete silo construction. Their forms are adaptable also to other classes of circular construction, such as grain bins, water-supply tanks, etc., with any required thickness of walls. In fact, a contractor owning this equipment can find an unlimited field for its profitable operation.

A new catalogue just issued by the Company, which will be mailed free to anyone interested, on request, explains and illustrates all phases of work on which the Polk equipment is used. The following are among the special advantages claimed:

The Polk Silo Equipment is built very strong. It carries its own scaffolding, and is automatically raised by the two jacks on the center mast. The silo may be built any height or diameter by using the proper size molds, and will not vary from a true circle, even thickness of wall, or a true perpendicular.

You can build 8 feet per day, with four men—which is rapid work.

A specially important feature is the possibility of water-tank construction on top of the silo. Farmers need a water supply. Water in the barn, for live stock and poultry; in the house, that modern conveniences may there be enjoyed; and kept in available store as a fire protection, not only is a constant source of comfort and satisfaction, but enables you to reduce insurance rates.

The Company will furnish the purchaser with the services of an experienced man for three days. He will show you how to set up the machine and teach you to build a monolithic silo. By having this expert teach you, your job will be right. All jobs thereafter will be equally well done.

The Company will give you, free of extra charge, very valuable assistance in starting the silo building business in your community. Let them lay their proposition before you.

Furnishing Contractor with Cement, Sand and Stone

To the Editor: Outagamie County, Wisconsin, opened bids Jan. 24 for about \$500,000 worth of concrete road contracts. One of the interesting things about this work is that we have contracted not only for the cement, but the necessary sand and gravel or stone has already been contracted for and will be furnished the contractors at the nearest railroad stations.

One of the biggest problems that we had to contend with last year, during which time the contractors furnished their own material, was that road contracts were being held up by the inability to secure material and cars during the busy construction months of June, July, August and September. This year we have just purchased a Byers unloading crane, material has been contracted for, deliveries will start the first of April, and by the first of July we expect to have all the necessary material unloaded in stock piles along the site of the work, before the car shortage and lack of material becomes noticeable. This will relieve the contractors of all worry as to where and when they can secure material; neither need they worry as to the quality nor demurrage on cars.

Another advantage, it seems to me, is that the county can maintain an inspector at the pit or plant where the material is loaded, and any rejections that are to be made can and will be made at the plant end of the line. Rejections of material, we have found, that are made when the material reaches the site of job, either f. o. b. cars or when hauled to the site of the work, will often tie up a contract for several days. This year we can inspect all of our sand and gravel, some 80,000 cu. yd., with two inspectors, one at each plant, in three months. This inspector will be in constant communication with our office, and each evening will report the cars and their numbers accepted and shipped that day.

It seems to me that by taking the above precautions, co-operating with the contractors in securing and furnishing them material, by having already contracted for and bought 90,000 bbl. of cement and 80,000 cu. yd. of material this early in the season, that we should secure the best of bids and build out roads at a minimum cost to the taxpayers of Outagamie County.

W. J. Driscoll, Secretary,

County-State Road and Bridge Committee.

Appleton, Wis., Jan. 12, 1917.

Concrete Pipe Association

J. H. Libberton, 210 South La Salle Street, Chicago, was elected Secretary of the American Concrete Pipe Association at its annual meeting February 15. Mr. Libberton is Division Engineer of the Promotion Bureau of the Universal Portland Cement Co., and has made extensive investigations in connection with the use of concrete tile in the mid-western states, having done extensive promotion work and made investigations on concrete drain tile in 1908 and 1909 when the business was in its infancy. He succeeds E. S. Hanson, editor of the "Cement Era" who has been Secretary of the Association since 1913 when the Association was formed.

Plans are now in progress to increase the membership of the Society and to develop greater usefulness to the members.

Du Pont Company Has Completed Road Building Film

Much has been said and written relative to the building and improvement of roads, but the latest means taken to further the educational side of road construction and maintenance is a road building moving picture film, made at a considerable expense by the direction of the Du Pont Company of Wilmington, Del. This firm has always manifested a great interest in all public movements from which the people reap a benefit.

This film taken from actual construction scenes, shows the very latest up-to-date road building methods and will surely fulfill its object, the education of the general public.

The plans are to have it shown at the meetings of farmers, road builders, automobile associations and other gatherings when it can best be seen by those most directly interested in roads.

In brief, this film shows the troubles from bad drainage and mud, and how these troubles are corrected; the troubles and dangers from boulders and stumps in and near the road, and how to get rid of them; objections to heavy grades; easier and quicker methods of grading, stone crushing and hauling; building several kinds of roads; repairing a dirt road; re-surfacing worn-out roads; and, finally, a completed road affording fast, easy travel.

The completed film is in two reels of about one thousand feet each, and requires about thirty-five minutes for showing. It makes an attractive, interesting, and instructive addition to any convention. The demand for it is already large and is still increasing, which shows that those interested are eager to learn, or know more so as to enable them to talk and work intelligently on road subjects, thus lending their co-operation and aid for the upbuilding and progress of the whole nation, for improved roads are merely an indication of how progressive a community really is.

New Cement Plant for Iowa

A railroad rate that will place his product upon the same cost basis as the product of other plants in Iowa and nearby territory has been assured Frank E. Tyler of Kansas City, who has purchased lands between Linwood and Buffalo, Iowa, for a new cement plant.

The rate, it has been learned through authentic sources, was assured Mr. Tyler by the Rock Island road recently when he visited officials at Chicago.

The lands from which Mr. Tyler expects to draw stone for his cement products is on the southwest division of the Rock Island lines.

Railroad officials told Mr. Tyler that the rate he would be able to obtain on heavy shipments would be the same that other Iowa and middlewest plants enjoy.

A plant of the size Mr. Tyler expects to build would mean a daily shipment of from 40 to 60 cars.

Crushes White Stone and Marble-dust for Concrete Work

Conlin & Co., Tuckahoe, N. Y., are now manufacturing crushed white stone and marbledust for concrete products. This material livens up the concrete work and improves the appearance of concrete blocks, bricks and other concrete products; adds to looks of stucco and is unsurpassed for brilliant floor finishes. It is unexcelled for white plastering and exterior plastering. Send for sample and let them quote you prices.



Fig. 1. New Grain Elevator of the Western Maryland Railway at Port Covington, Baltimore, Md. View from Water Front.

New Grain Elevator of the Western Maryland Ry, at Baltimore, Md.

The Western Maryland Ry. has just completed a very modern and large capacity elevator and grain handling plant at Port Covington, in upper Baltimore (Md) harbor. The railroad has an unusually advantageous property at this point, comprising about 1000 acres, and more than a mile of frontage on deep water. At one end of this property is located a large coal dock which the Western Maryland has been operating for a number of years, but the balance of the property has been almost entirely undeveloped until now. Between the new elevator and the old coal dock a new coal pier is to be built in the near future, which will involve an investment of some \$2,500,000 and completely modernize the facilities of that class at this place. In connection with both the elevator and the new coal dock an

extensive terminal yard will be developed, having a capacity of some 5000 cars. A part of this trackage is already being laid, and a part will be deferred until the dredging for the new coal pier makes available filling material which is needed in considerable quantity at certain locations.

The grain handling facilities which are just completed consist of a group of 24 concrete storage tanks with intermediate bins; a concrete working house; loading galleries extending 800 feet. in one direction from the working house and 1000 ft. in the other direction, and a marine tower for unloading grain from incoming vessels. Views of the entire plant are shown in the accompanying illustrations. The minimum depth of water in the slip is fixed at 32 feet., but the actual depth at this writing is 35 feet. The width of the slip has been 250 ft., but dredging is now in progress to increase this width to 450 ft.

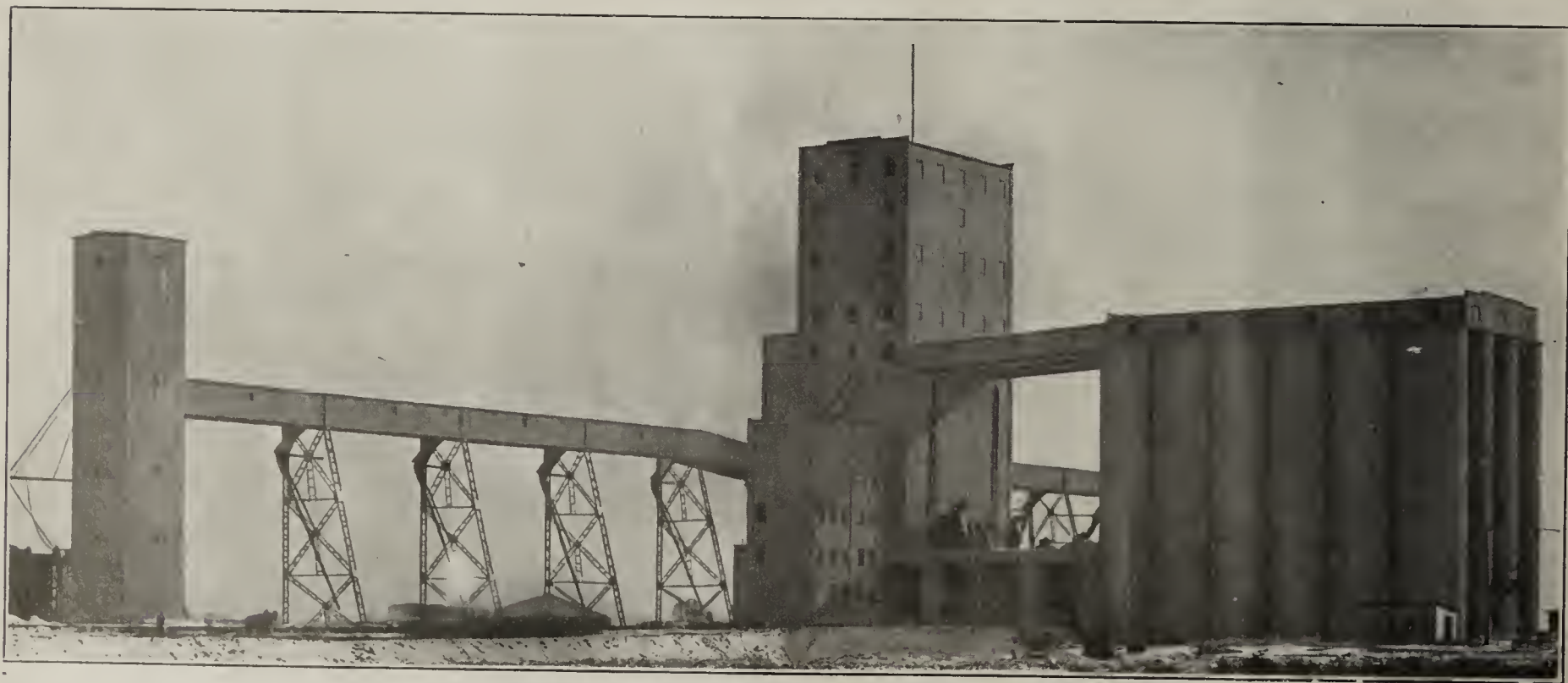


Fig. 2. New Grain Elevator of the Western Maryland Railway at Port Covington, Baltimore, Md. View from Rear.

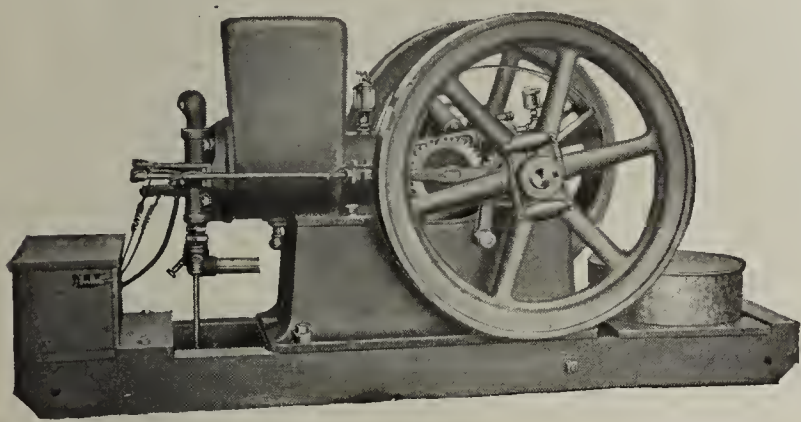
The plant is constructed of reinforced concrete throughout, and the operation is entirely by electricity from power purchased locally. The only steam used is in the grain drying equipment. There are a number of improvements in the grain handling machinery and the apparatus for controlling it; some of which are original in this plant, and many of which have rarely, if ever, been combined before in one up-to-date plant.

This modern plant was designed by Max Toltz, Toltz Engineering Co., St. Paul, Minn. It was built by James Stewart & Co., contractors, Chicago. It is now operated by the Western Maryland Ry., under the immediate supervision of J. A. Peterson, superintendent, who also has offices at 106 Chamber of Commerce building, Baltimore, Md.

Thompson Gasoline Engine

Practically every reader of this paper could use to great advantage a gasoline engine. This is rather a broad statement, but it is true. The gasoline engine does so many things that the average cement contractor cannot afford to do by hand-power. Horsepower is cheaper than hand-power.

The Thompson Plow and Engine Works, of Beloit, Wisconsin, manufacture gasoline engines. They know this business thoroughly inasmuch as they have been building engines for a good many years, and these years have given them a practical experience in this line that could be gained only in this way. So today the gasoline engine they produce is one of most improved type, one that is simple in construction, one that will do the work required with a minimum amount of expense for upkeep.



The Thompson Company have confidence in their goods, and want to secure your confidence. They have goods of the highest quality, and want a market, and you, readers, are the market. Consequently, when they have gained your confidence, half their battle is won. Their selling plan is positively fair and liberal, and is a plan that will appeal to you and your fairness. In other words, they take all the chances; and if the goods are not as represented, you are not a penny out. Further they give you a five years' guarantee, and back this guarantee to the limit.

The Thompson Company are actual manufacturers. They have an enormous factory in Beloit, established away back in 1860, and they have "made good." They are, it is said, the largest manufacturers of gasoline engines in the world selling directly to the consumer. Their factory covers over 20 acres of floor space. This success would not have been built up, but for three things—Price, Quality, Honest Dealings. Increased output means lower manufacturing cost, and you get the benefit of the latter. Their catalogue, which explains all about their selling plans, is very interesting and should be on your desk. It cost a lot of money to produce, but costs you nothing.

Effect of Sugar on Concrete While Setting

Recently there have come to our attention several examples of the effect of sugar on concrete while setting. This leads us to bring more generally to the attention of contractors the fact of the harmful effect of sugar, a fact that has been generally known only in the testing laboratories.

In one case that came to our attention the contractor placed a concrete floor on a wooden floor of a candy factory. Years of dripping sugar had coated the floor with sugar and though it was cleaned before the concrete was mixed on it, the water dissolved enough sugar to ruin the concrete. After ten days it was still so soft that it could be removed with the fingers. The floor had to be relaid at the expense of the contractor, and the owner had his work seriously interrupted at his busiest season. The materials used were carefully tested and were of good quality as was the workmanship, but the relatively small per cent of sugar absorbed in the mixing ruined an otherwise good piece of work.

In another case a failure of a cinder concrete floor was traced to sugar in cinders that had come from a sugar refinery. First, information showed that the cinders had been loaded directly from the ash pits to the scows and thence taken to the work. Further investigation, however, showed that some of the refinery sweepings had been dumped on the ashes.

Following is a report of tests made on this subject at the Lewis Institute. An examination of this report will show that practically all the specimens containing sugar disintegrated and showed no strength at all. A few, however, stuck together long enough to get into the testing machine, but the mere weight of the machine broke them.

These tests show that as small an amount of sugar as one pound to ten bags of cement will cause failure.

Effect of Sugar on the Strength of Sand Mortars

1:3 Sand Mortar—Sand from Elgin, Illinois.

Specimen tested at 7 days had been stored 1 day in moist air and 6 days in water. Those tested at 28 days had been stored in moist air.

Specimens made on 4 different days.

Sugar content is in percentage of sand by weight.

Results of mortar strength test are in pounds per square inch.

Sugar Per Cent	H ₂ O Used, Per Cent	Compressive Str. 2x4 Cylinders		Tensile Str. Briquettes	
		7 Days	28 Days	7 Days	28 Days
0.0	10.9	2000	3090	370	808
0.05	10.9	Nearly	4020 b	Nearly all	...
0.1	10.9	all speci-	2830	specimens	...
0.2	10.9	mens dis-	220 b	disintegrated	85 c
0.5	10.9	integrated	110 c	in water	50 c
1.0	10.9	in water	170 b		WJ c
2.0			110 c		WJ c
Ottawa	10.5	1230		261	349

Notes: WJ indicates that the specimen broke under the weight of the jaws of the testing machine.

The mortar strength values are averages of tests on 4 or more specimens unless otherwise indicated—a 5 specimens, b 2 specimens, c 1 specimen. The sand was a high grade sand from Elgin, Ill., and showed the following sieve analysis: Finer than each sieve.

A Virginia Sand and Gravel Plant

Equipment handles 300 cubic yards of material per day

The country-wide good roads movement, and the increasing popularity of concrete for building purposes, are giving a great impetus to the sand and gravel business.

As is the case with all growing industries, new equipment is being rapidly designed to efficiently carry on the work.

An illustration of a typical arrangement for producing this kind of material is the recently installed



Loading the Dragline Cableway Excavator.

plant of Mercer and Miller at Little River, Virginia, and the accompanying cuts show different stages in the process of getting the sand and gravel into bins.

This installation is a Shearer and Mayer dragline cableway excavator with a 1-cu.-yd. bucket. The wire rope equipment consists of 520 ft. 1 $\frac{1}{8}$ -in. for main line; 700 ft. $\frac{5}{8}$ -in. rope for operating lines; 1 $\frac{1}{4}$ -in. for main guys, and $\frac{3}{4}$ -in. for auxiliary guys, furnished by A. Leschen & Sons Rope Company.

The length of the span is 450 ft., and the mast is 75 ft. high. Power is supplied by a 50-horsepower Lidgerwood hoist. Daily capacity of this plant is about 300 cu. yds.

This plant is located about one mile from the main line of the C. & O. Railway, and Mercer & Miller have put in a standard-gauge connecting track over which they operate cars with their own engine.

With the purpose of further increasing the efficiency of this plant, Mr. Mercer of this company is designing a new washer, which, it is said, will have many new and important features.

New Way to Save Dynamite

The European War has created a great shortage in most of the essential ingredients which are necessary in the manufacture of high explosives and blasting supplies. The prices of raw materials have advanced anywhere from 25 per cent to 1,000 per cent, and more. Just now conditions are very acute and no relief in sight. Consequently it has been necessary to increase the price of explosives to the consumer. Even at present prices manufacturers are netting less profit than in normal times.

On this account you, Mr. Purchasing Agent or Mr. Superintendent, can, if you select wisely, make a big saving in explosives cost per ton, writes the Du Pont Powder Company. The tendency in most work where explosives are employed is to use an explosive stronger than necessary for the work at hand. Oftentimes purchasers of explosives are influenced by the petty prejudices of the man for a certain brand or kind of dynamite. In many classes of work where gelatin or straight dynamites are at present used an Extra or Ammonia dynamite would do the work equally as well at much less cost. Are you aware that it requires about 15 per cent more gelatin per foot of hole, if the same height of loading is maintained, than it does of Red Cross Extra Dynamite? In a 5 $\frac{5}{8}$ -inch well drill hole containing 50 ft. of gelatin you would have about 750 pounds, while if Red Cross Extra were used 625 pounds would do. A saving of 125 pounds! Again, at the present time a 40 per cent gelatin or straight dynamite costs about 30 per cent more than a 40 per cent R. C. Extra dynamite.

You can afford to use a 10 per cent or even a 20 per cent higher grade Extra dynamite than straight or gelatin, thus making a considerable saving in your explosive cost.

Think it over! Surely a saving of anywhere from 10 per cent to 50 per cent is worth trying for.



Dumping Load Into Bin at Plant, Mercer & Miller Gravel Company.

How to Make Pit Run Gravel Into Good Concrete

Many inquiries are received by the Minnesota highway commission, so their engineers state, in regard to the proper amount of cement to be used with pit-run gravel to make good concrete for bridges.

This question is very hard to answer accurately, because no two gravel pits are alike, and often there is a wide variation in the quality of gravel in the same pit. Good pit-run gravel should be clean, hard, free from slate or soft stones, and when separated into sand and pebbles, by screening, should yield about twice as many pebbles, by volume, as sand, the sand grading from $\frac{1}{4}$ -inch size down. The pebbles should vary from $\frac{1}{4}$ inch to $1\frac{1}{2}$ inches in size. Such material will make good concrete when mixed, one part of cement by volume, to four and one-half parts of pit-run gravel.

Examination of many samples of gravel from all parts of the state shows that with few exceptions the pit-run material contains too much sand in proportion to the pebbles. In many cases there are practically no pebbles, and frequently there are impurities in the sand, such as clay, slate, silt, vegetable matter, etc., which may make the gravel unsuitable for concrete work.

Concrete gets its strength from the mortar which binds the stones into a solid mass. If the strength of the mortar is kept constant, by using the same mix of cement to sand, the stones can be partly or wholly left out without materially weakening the concrete.

In using pit-run gravel, if one part of cement is used with every two and one-half parts of sand contained in the gravel, a good concrete should result, provided there are little or no impurities. If there are impurities present, the proportion of cement should be increased. For the average pit-run, the mix should be about one part of cement to three parts of gravel, and in many cases it should be one to two and one-half, or even one to two. This will require from eight and one-half to twelve and one-half sacks of cement per cubic yard of concrete.

The proper and accurate way to make concrete is to separate the sand and pebbles by screening, and remix them with cement according to definite proportions. If there is not enough of the pebble proportion, crushed rock or screened pebbles should be shipped in. The standard mix for bridges is in the ratio of one, two and one-half, four, or one part, by volume, of cement to two and one-half parts of sand to four parts of screened gravel or crushed rock. This requires five and one-half sacks of cement per cubic yard of concrete, and with good materials, gives excellent results. The amount of sand is cut down to a minimum, thus reducing the effect of impurities which, if present, are generally in the sand.

The saving in cement by using screened materials will frequently pay for the extra cost of obtaining them. If there is any extra cost it is money well invested.

The use of screened, and if necessary, washed materials is strongly advocated. It insures first-class results and places the making of concrete on a definite basis, instead of trusting to luck as to what the gravel will be, and what part of a specified pit will be used.

Such concrete work built under competent inspection would be a great deal stronger than pit-run gravel concrete. It would be possible in many cases to make walls and slabs thinner, and thus affect a further saving in cost.

Quarry of the Allentown Portland Cement Company

The accompanying illustration is a view of the quarry operated by the Allentown Portland Cement Company at Evansville, Pennsylvania. The material is a low limestone formation which is deposited in irregular layers. The face of the quarry varies from 35 to 100 feet in depth. The holes for blasting are drilled with $5\frac{5}{8}$ -inch well drills, manufactured by the Sanderson Cyclone Drill Company, Ormville, Ohio, the spacing of the holes varying from 16 feet by 18 feet to 20 feet by 22 feet, although at some parts of the quarry greater spacing is used. The blasting is all done with Du Pont dynamite.

An Atlantic steam shovel loads the rock into $3\frac{1}{2}$ -ton cars. From 700 to 900 tons of rock are loaded per day. The cars are of the company's own make and are of



Steam Shovel with $2\frac{1}{2}$ -Yard Dipper, Loading Rock, Allentown Portland Cement Company.

all steel construction. They are handled by gravity and horses from the shovel to the incline, a distance of from several hundred to 1,000 feet, where they are hauled up by an electric hoist. They are equipped with end dumping doors which open automatically and the load discharged when the proper position over the crusher is reached. Only twelve to fourteen men are employed in the quarry, including the shovel crew of three men and the drill crew of two men. This force does all the loading of rock and practically all of the stripping. The stripping, however, is not very heavy and is done with a plow and scoop. It amounts to so little that it would not be practical at the present time to do it by steam shovel or other methods.

The main crusher is a No. 10 McCully, manufactured by the Worthington Pump and Machinery Corporation, Power and Mining Machinery Works, of Cudahy,

Wisconsin, which in turns feeds into two No. 6½ crushers.

Mr. A. E. Douglass is superintendent, and he states that the crushers have given very good service and that repairs are very low.

A Stone Crushing Problem Solved

Several months ago a concern in Iowa came to us with their problem which was the crushing of hard iron ore, in one operation, to a size ranging from 4 inches down to 2 inches, with the minimum of fines. They were up against it, so to speak, in that the ore coming from the mine was large and extremely difficult to handle. Some of their cubes weigh 6 tons and measure 6 feet long by about 3½ feet in diameter. Their material was of such size that a Gyratory crusher would not take in these large cubes.

We took the case under advisement and after careful study recommended the No. 9 Williams Mammoth crusher. We guaranteed this machine to take their large cubes and to crush them down to the size they desired, with the minimum of fines, which were objectionable. The hammers on a Williams Mammoth crusher weigh 72 pounds each, the journals are 26 inches long and weigh 1,500 pounds each, the fly wheel weighs 5,200 pounds. The crusher is so constructed that it will withstand the severest kind of work.

They followed our suggestion and installed this machine at their mine; to test it out thoroughly they first fed it with the smaller cubes of their ore, which were crushed easily and to the size desired. They then desired to give an extremely severe test, and with this in view fed in a cube of ore which weighed 6 tons. This cube was crushed in exactly sixty-seconds, giving the crusher a capacity on this class of work of 360 tons per hour.

Of course crushing hard iron ore and limestone in one respect is very similar. The quarry operator has to contend with large cubes of stone just as the mine operator must contend with large cubes of iron ore. Some operators wish to make a minimum of fines in crushing to certain sizes, and some wish to make the maximum of fines, for instance in cement work. This Williams Mammoth crusher will serve both purposes equally well; all that is necessary is the proper equipment of hammer and cages. We can give you the maximum of fines if you desire or the minimum of fines, whatever you wish. Therefore, if you have a crushing problem before you write for our bulletin 17-A explaining this machine in detail. We will gladly send you a copy and give you all the information you desire.

Yours truly,

The Williams Patent Crusher & Pulverizer Co.,
Old Colony Bldg., Chicago.

Jeffrey's New Cleveland Office

The Jeffrey Manufacturing Company of Columbus, Ohio, announce that they have recently opened a new branch office in Cleveland, Ohio, 421-423 Rockefeller Building, which will be in charge of Messrs. W. E. Holloway and C. B. Reed.

Both of these gentlemen have been connected with The Jeffrey Manufacturing Co. for a number of years, and have had long and successful experience in sales and engineering work, which will prove of great assistance to customers in solving their elevating, conveying, screening, crushing, pulverizing, transmission and mining machinery problems. We are confident their efforts to give the trade the best possible service will be appreciated.

Imports and Exports of Cement During the month of Dec. 1916

Imports			
Districts	100 lbs.	Dollars	
Maine and New Hampshire	12	14	
New Orleans	26	214	
Duluth and Superior	120	59	
Total	158	287	
Exports			
Countries	Barrels	Dollars	
Bermuda	825	1,353	
British Honduras	385	707	
Canada	1,817	2,893	
Costa Rica	1,059	2,031	
Guatemala	1,690	3,146	
Honduras	780	1,466	
Nicaragua	1,100	2,160	
Panama	20,525	31,339	
Salvador	3,056	5,837	
Mexico	8,882	20,265	
Jamaica	3,554	6,937	
Trinidad and Tobago	3,000	4,350	
Other Br. W. Indies	350	573	
Cuba	60,903	100,913	
Danish W. Indies	50	138	
Dutch W. Indies	1,275	3,284	
Haiti	2,123	3,446	
Dominican Republic	4,201	6,997	
Argentina	9,506	13,622	
Brazil	57,237	83,719	
Chile	6,600	10,211	
Colombia	5,396	10,010	
Ecuador	4,200	6,220	
Br. Guiana	800	2,110	
Peru	15,937	28,795	
Uruguay	500	785	
Venezuela	5,927	9,543	
Dutch East Indies	852	2,103	
French Oceania	265	530	
Portuguese Africa	102	194	
Total	222,897	365,677	

Wire Rope Information

Captain H. B. Sauerman, of Sauerman Brothers, 1139 Monadnock Block, Chicago, is the author of a valuable booklet entitled "Practical Wire Rope Information and Useful Information on the Drag Line Cableway Excavator." This book takes up in detail all matters pertaining to the use and care of wire rope, such as its construction and properties, comparative strength, methods of handling, lubrication, splices, etc., illustrated with a large number of drawings.

The pages devoted to the cableway excavator supply as complete a treatise on this device as has ever been compiled.

Ganshow Gears

A volume which has come to be a standard reference book to many people on the subject of gears is the general catalog published by the William Ganshow Company, 1003 West Washington boulevard, Chicago.

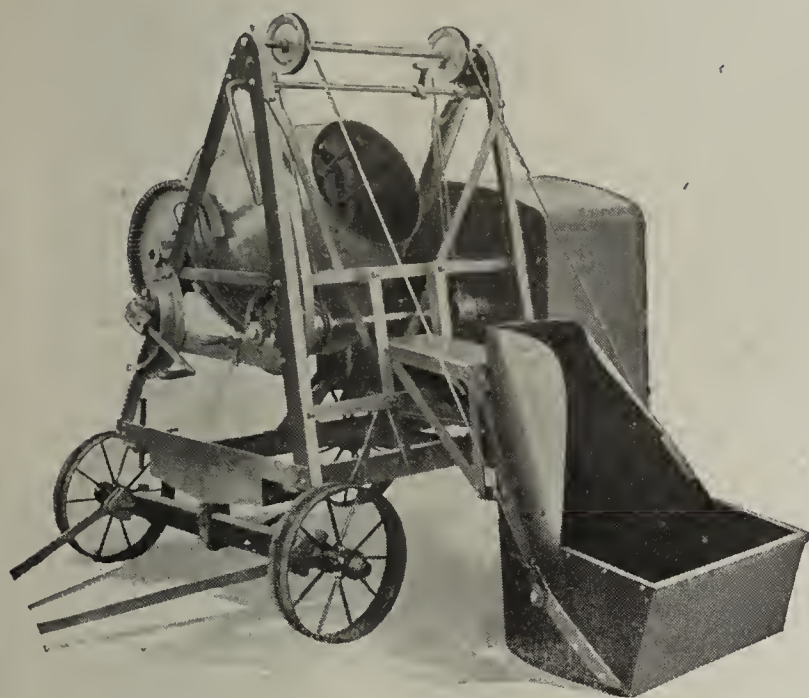
This is a volume of nearly 300 pages, and takes up in a detailed way practically all known kinds of gears and details of construction, uses, etc.

The William Ganshow Company is anxious to have a copy of this book in the hands of every man who buys gears for cement plants.

JAEGER

BIG-AN-LITTLE

MIXERS



Everything a batch mixer ought to have is contained in this machine.

Our Tilting Drum guarantees a perfect speedy mix—single opening, large capacity, easy to load and unload and always clean.

The Drum is entirely open to view at all times.

The Mixer has proven by test to be most economically operated.

And, don't forget, you get A MIX A MINUTE.

Our new folder shows the entire line.

Write for your copy now.

**THE JAEGER MACHINE COMPANY 212 W. RICH STREET
COLUMBUS - OHIO**

Five Austin Drum Mixer Features—

1. **Wide loader and opening** into drum permit fast charging without clogging.
2. **Design of mixing blades** is such that the mix is carried over on discharging chute very wet, allowing rapid discharge, either entire batch or part.
3. **4-H. P. hopper-cooled** gasoline engine, or steam or electric power. Twenty-gallon steel water tank and steel engine housing.
4. **One position control.** Capacity, 60 to 80 cu. yds. per day.
5. **Designed and constructed** throughout to maintain the high-quality reputation earned for its manufacturers by their Austin Cube Mixers.

Municipal Engineering & Contracting Co.

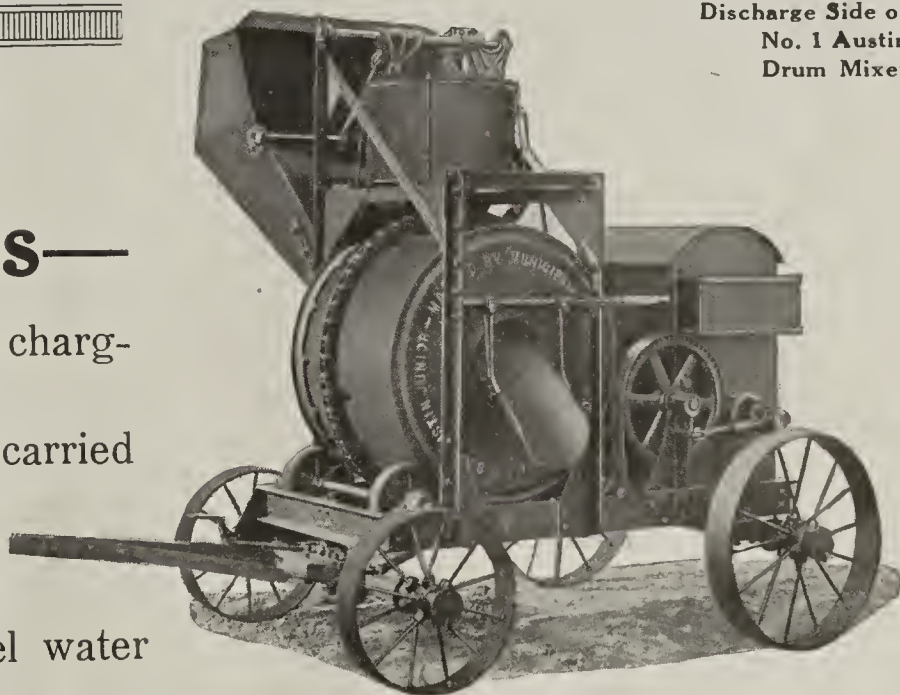
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New England Agents: Dyar Supply Co.,
Cambridge, Mass.

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Coast { Howard, Cooper Corp., Portland
F. S. Burbank Co., Seattle.

E. Canada, A. A. Scully, Stair Bldg., Toronto

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Drum Mixer



"Concrete for
Permanence"

**Municipal Engineering
& Contracting Co.**

Railway Exchange Bldg.
Chicago

Send me catalog No. 21-D. I want to know more about high-grade, low-priced drum mixers and pavers made by the builders of Austin Improved Cube Mixers.

Name.....

Address

SIGN, CLIP HERE AND MAIL

CAYUGA SUPERINTENDENT DIES.

John F. Rehn, superintendent of the Cayuga Cement Corporation's plant at Ludlowville, N. Y., died recently following a short illness of pneumonia. Mr. Rehn, who was thirty-six years of age, was a graduate of the Massachusetts Institute of Technology. He had been at the Ludlowville plant since July. His home was in New London, Conn.

GIANT HAS GOOD EARNINGS.

Philadelphia bankers' offering Giant Portland Cement Company first serial six per cent bonds, say in a circular: "The company reported income last year in excess of $3\frac{1}{2}$ times the interest charges and cash in the treasury outstanding (\$700,000), out of surplus earnings liberal provision has been made for depreciation, obsolescence and other business contingencies."



Portable Derrick Clamshell Unloading Aggregates for Concrete Road Work Into Portable Bins Chuting to Dump Cars.

Materials Unloading and Loading Plant for Concrete Road Construction

The illustration shows a materials handling plant for road construction at Catlin, Ill., one of the receiving points for a contract calling for 15.39 miles of concrete and 3.16 miles of monolithic brick pavement. This is one of the contracts on the Vermilion county, Illinois, bond road system held by the Granite City Lime & Cement Company, Granite City, Ill.

The materials come in on cars and are unloaded into portable bins using a portable derrick, operating a $\frac{1}{2}$ -cubic yard clamshell bucket. The capacity of the unloading outfit is 300 tons in 10 hours, but on the work in question this capacity is rarely demanded. From the portable bin the material is chuted into $1\frac{1}{2}$ -cubic yard dump cars. The bin is between two dump car tracks and cars are loaded from either or both sides. Forty cars and $3\frac{3}{4}$ miles of railway deliver the materials onto the grade. The trains are hauled by 24-inch gage, 9-ton locomotives at a maximum speed of 12 miles per hour. Ordinarily 7 to 10 trips are made per 10-hour day with 10 to 16-car trains. A track gang of two to three men is required.

The unloading derricks are the Model B portable machine, made by the John F. Byers Machine Company, 260 Sycamore street, Ravenna, Ohio, and the bucket is made by the Ruddock Bucket Company,

Cleveland, O. The portable bin and the dump cars are Western Wheeled Scraper Company make.

New Westinghouse Plant

Announcement has just been made by the Westinghouse Electric & Mfg. Company that the plot of ground recently purchased at Essington, near Philadelphia, will form a new industrial center for the Westinghouse Electric interests. The site embraces about 500 acres, with a frontage of approximately one mile on the Delaware River. Additional transportation facilities will be afforded by tracks from the Pennsylvania and Philadelphia and Reading Railroads.

This new center will be devoted to the production of large apparatus, the first group of buildings being for power machinery, principally steam turbines, condensers, and reduction gears. The initial development will cost in the neighborhood of \$5,000,000 or \$6,000,000 occupying about one-fifth of the area of the entire plot. The group will consist of the following buildings: two large machine shops, an erecting shop for heavy machinery, forge shop, pattern and pattern-storage shop, and power house. Work will begin on these as soon as satisfactory building contracts can be let.

The number of employees to be engaged at the new plant has not as yet been definitely determined but will number several thousand people, and undoubtedly will in the future equal the number employed at East Pittsburgh, representing over 20,000 people.

STREICH Dump Wagons



1. Chicago Second Regiment Armory Job.
W. J. Newman, Contractor.

2. Chicago Lake Front Improvement.
The Ryan Co., Contractors.

¶ About 90% of the Dump Wagons purchased in the City of Chicago are Streich's. There is a reason. Our wagons run easily because the axles are properly set, and wear long because they are made of the right kind of stuff.

¶ This wagon will dump anything from cinders to the stickiest kind of clay. Weight of contents of load when dumped automatically forces the bottom doors up the sides of body, allowing bottom doors to clear pile. You never see a Streich wagon stalled and you never see a driver shovel in order to get free after a dump.

¶ We build One and Two Horse Wagons from one yard to four yards capacity.

Write for catalog showing complete line of Dump Wagons, Garbage and Asphalt Wagons.



A. STREICH & BRO. COMPANY OSHKOSH, WISCONSIN.
CHICAGO OFFICE: 553-565 WEST LAKE ST.

CEMENT DRAIN TILE



W. E. DUNN MFG CO
HOLLAND MICHIGAN

BULLETIN No. 1 covers the possibilities of Drain Tile as a business. This includes materials required, complete costs, selling prices and profits. It tells what others are doing in this business. How the demand is rapidly increasing and why cement tile are preferred by users.

BULLETIN No. 2 covers manufacturing. How to successfully start and operate a tile plant. Points to consider regarding location and building. Arrangement of equipment for best production. Describes different curing methods and relative costs. Tells what proportions of materials should be used and how mixed.

BULLETIN No. 3 deals with selling the product. Best methods to use for securing local business. How to get business from nearby towns. It also illustrates advertisements for use in local newspapers.

The Tile Business Fully Described

This instructive book on cement tile completely covers the three big subjects: **Possibilities of the Business, Manufacturing and Selling.**

It also describes suitable equipment for both large and small plants. For small plants as well as general cement products plant we recommend the Dunn No. 1 Machine, because it can be easily installed, occupying little space and can be operated successfully and profitably by 1, 2 or 3 men.

For large plants we have the Dunn Automatic, which makes a larger tile and has a larger capacity.

We Want Only Successful Plants. We investigate local conditions for any prospective purchaser. If not right, we advise you not to buy. If right, we go the limit with you. We try to eliminate failures. They are not necessary. We cannot afford that risk any more than you can, as every sale we make is absolutely on our **15 days' free trial offer**—your money back if not satisfied.

Write today for this tile book. We send it absolutely free.

W. E. DUNN MFG. CO.

414 24th Street

HOLLAND, MICH.

Practical Hints on Concrete Construction

During the course of an illustrated lecture relating to concrete construction on the farm, the writer, who had traveled throughout all the important agricultural districts east of the Mississippi taking notes and photographs of various examples of concrete construction on hundreds of farms, was asked what proportion of farm work of this character resulted in failure. He replied that failures were exceedingly few, and that if farmers were instructed as to the use of proper aggregates, failures would become practically unknown.

The following brief instructions concerning the essentials of good concrete have been prepared for the information of farmers, who will find them convenient as reference data. If strictly observed they will insure satisfactory results.

Aggregates to Be Used in Concrete Construction

The sand, stone, and gravel usually found upon the farms of the United States are generally suitable for concrete construction, provided the following precautions are taken:

1. These aggregates must be free from vegetable matter, dirt, or other foreign substances.
2. When using bank-run gravel, the sand must be separated from the stone or pebbles by screening through a $\frac{1}{4}$ -inch screen.
3. In small concrete structures, such as drain tile, fence posts, etc., the coarse aggregate (crushed rock or gravel) should range in size from $\frac{1}{2}$ inch to $\frac{3}{4}$ inch. For larger, such as silos, barn floors, ordinary foundations, etc., coarse aggregate should range from $1\frac{1}{2}$ to $\frac{3}{4}$ inch.
4. The sand should be coarse, hard, and clean, and graded from $\frac{1}{4}$ inch to fine, with the larger size predominating. Use great care in hand mixing. It is economical to buy a small machine mixer if the farmer intends to use concrete in large quantities.

Hand Mixing

Proper methods when concrete is mixed by hand, using a two-bag batch of 1:2:4 proportions, are as follows:

1. Size of measuring box for sand should be 2 feet square by 1 foot high, thus containing 4 cubic feet.
2. Load sand in wheelbarrows and wheel onto mixing board.
3. Fill sand-measuring box, lift box, and spread sand 4 inches thick over board.
4. Take two bags of cement, place contents as evenly as possible over sand.
5. Turn the sand and cement over until thoroughly mixed, so that no streaks of cement or sand appear.

6. Spread the mixture of sand and cement out carefully, place measuring box beside it, and fill twice with stone or gravel, then empty onto sand and cement mixture and mix thoroughly.
7. Add three-quarters of required amount of water slowly and evenly, at same time mixing the mass.
8. Continue mixing, adding balance of water when dry spots appear, until whole mass has been turned over three or four times. This should be sufficient. After final turning shovel into compact mass ready for wheeling to place.

Bank-Run Gravel

Bank-run gravel is sometimes used as it comes from the bank. This is wrong, as no two places in a bank will have the same proportions of sand and pebbles. It is, therefore, always essential when using bank-run material to screen the sand from the gravel and remix in the proper proportions.

Ideal's New Catalog

A new large general catalog has recently been issued by the Ideal Concrete Machinery Co., 1353 Monmouth avenue, Cincinnati, Ohio, covering the complete line of Ideal Concrete Products Machinery for 1917.

This catalog, No. 28, shown herewith, is very complete, covering their entire line of concrete block and



brick machinery in hand and power equipments, ornamental molds, tycrete waterproofing compound and colors and also the Blystone Block plant mixer for which they are sales agents.

In addition to this, it contains valuable data on the manufacture of concrete products and some very useful information upon silo construction as well as a review of the concrete business in general. It is beautifully illustrated and withal a very handsome catalog, making it most useful to all workers in concrete. The company will be pleased to mail it to anyone upon request.

Quantities of Material for One Cubic Yard of Rammed Concrete (Table from Taylor and Thompson, "Reinforced Concrete.")

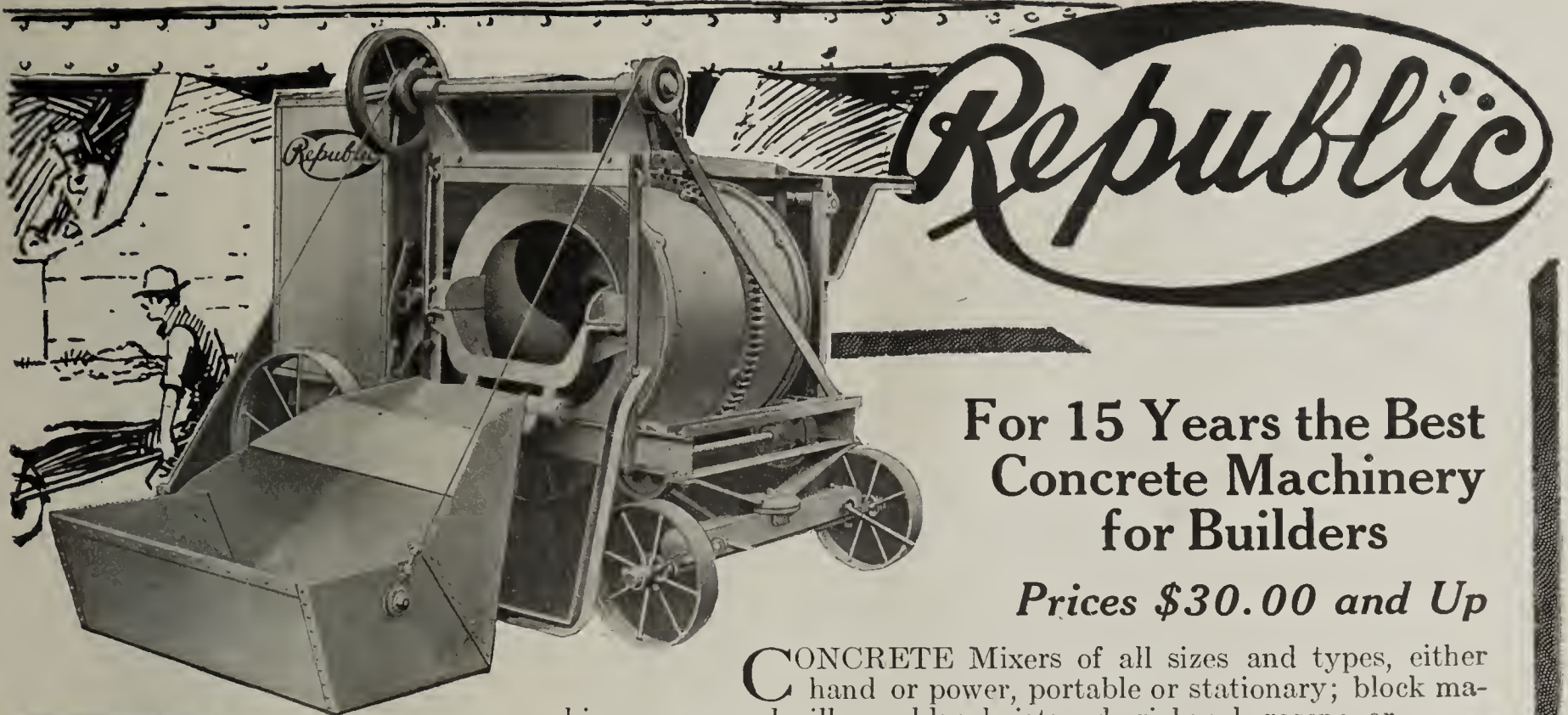
Proportions by Parts Percentage of Voids in Broken Stone or Gravel

Cement	Sand	Stone	50 Per Cent.*			45 Per Cent.†			40 Per Cent.‡		
			Cement, Bbls.	Sand Cu. yd.	Stone, Cu. yd.	Cement, Bbls.	Sand Cu. yd.	Stone, Cu. yd.	Cement, Bbls.	Sand Cu. yd.	Stone, Cu. yd.
1	..	2	3.57	..	1.06	3.37	..	1.00	3.20	..	0.95
1	..	3	..	..	..	2.60	..	1.16	2.45	..	1.09
1	2	3	1.81	0.54	0.80	1.74	0.52	0.77	1.67	0.50	0.74
1	2	4	1.58	0.47	0.94	1.51	0.45	0.89	1.44	0.43	0.85
1	2½	5	1.31	0.48	0.97	1.24	0.46	0.92	1.18	0.44	0.87

*Use 50 per cent columns for broken stone screened to uniform size.

†Use 40 per cent columns for gravel or mixed stone and gravel.

‡Use 45 per cent columns for average conditions and for broken stone with dust screened out.



For 15 Years the Best Concrete Machinery for Builders

Prices \$30.00 and Up

CONCRETE Mixers of all sizes and types, either hand or power, portable or stationary; block machines; cap and sill moulds; hoists; derricks; kerosene or gasoline engines; tools, etc. Think of "Republic" when you want anything in the concrete machinery line.

Republic "Ten"

See this splendid new 1917 model light weight sack size mixer. Can be furnished with either low charging portable platform or automatic power loader. **The best light weight sack size mixer built.** Prices very low.

Republic "Seven"

A medium size mixer of standard design. Equipped with standard hopper, batch hopper, power loader, building hoist, or rotary pump. **A mixer built for service and durability.**

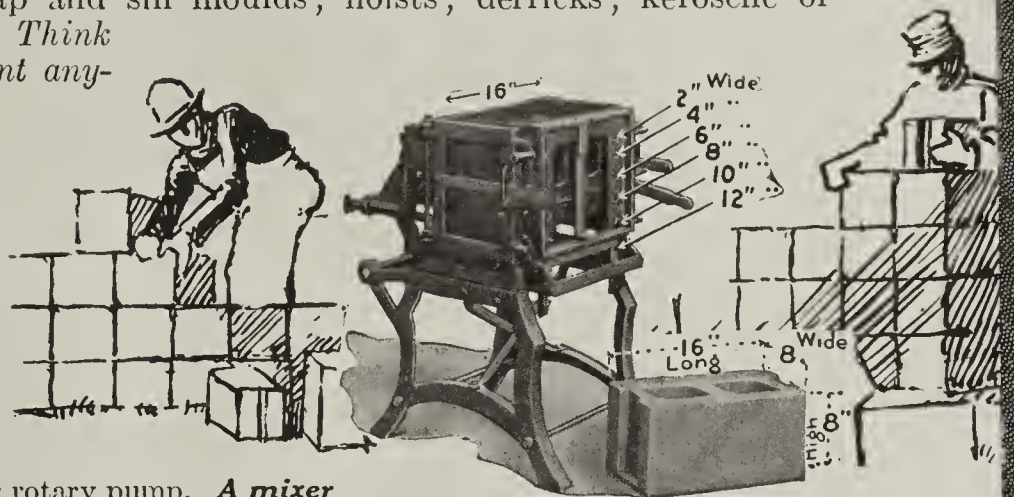


Republic "Five"

An extremely strong and durable medium and small size mixer. One of the best building and small contractors' outfits built. Silo and building hoists, rotary pumps, standard hopper, loader or any equipment you want. **Don't fail to see this mixer before you buy.**

Republic "Three"

A new model mixer for the small contractor and builder. **Lowest prices** combined with long wearing qualities, with convenience in operating and extreme portability. **\$30 and up.**



Monarch Cement Block Machine

Simple, rapid, face down, easy to operate. Adjustable to all standard widths from 2 to 12 inches. Makes blocks with faces in rich effects imitating rock, ornamental stone, etc. **Considered the standard of building block machines.**

Systematic

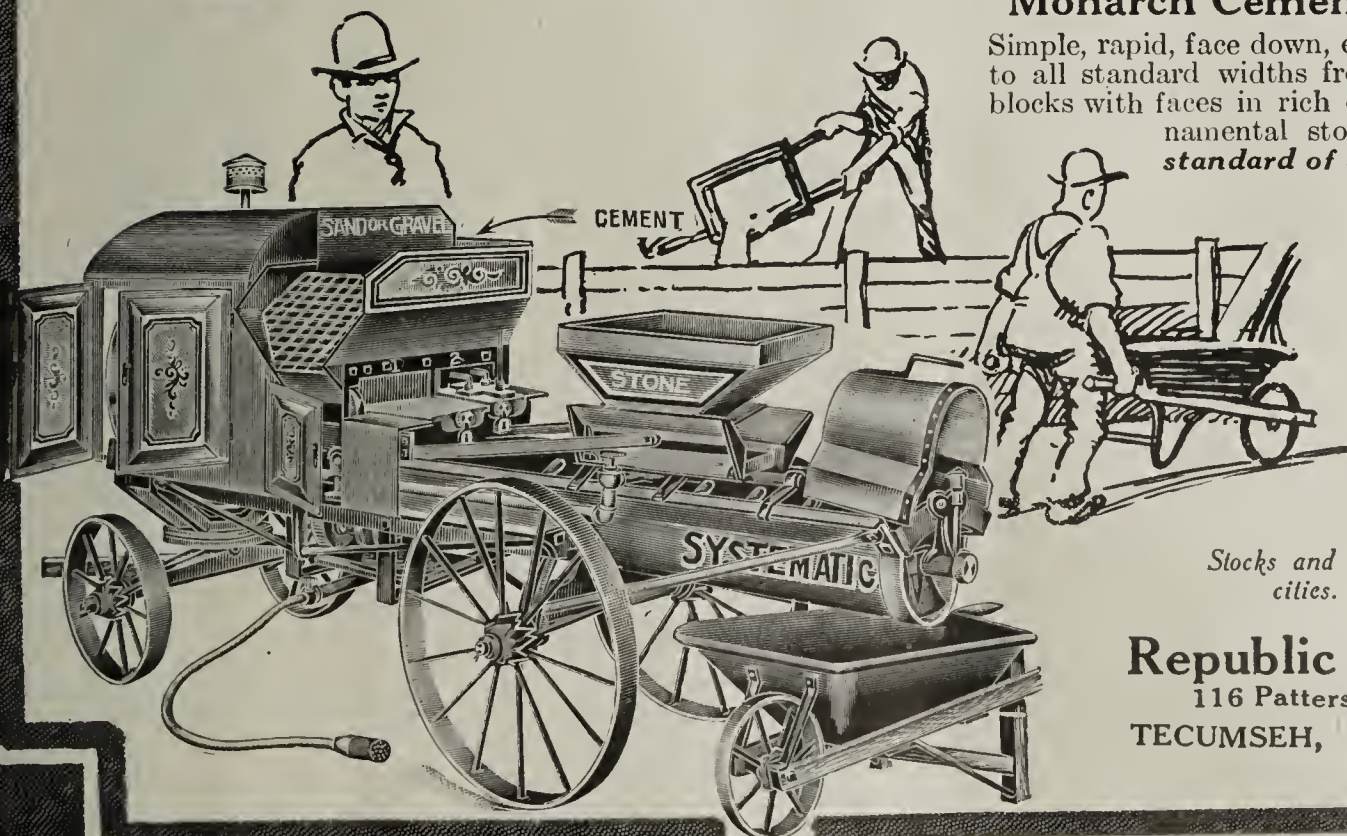
An automatic proportioning mixer with batch principle of measuring. A splendid machine for sidewalk, curb and gutter, and block and tile plants. Built in four sizes, with or without power.

Illustrated Catalogs Sent on Request

Stocks and dealers at all important cities. Get posted today!

Republic Iron Works

116 Patterson St., Box 454
TECUMSEH, MICHIGAN



The Proper Use of Concrete Gravity Chutes

By W. H. Insley and C. C. Brown

The concrete gravity plant has had a very rapid development because of its economy in the time and labor cost of distributing concrete and its practically universal adaptability. Like any new process which comes rapidly into general use because of its advantages, its use has outrun the rules of practice which a more conservative introduction would have established for it. Consequently every user has made his own rules with little guidance except his own experience and with as variable a product as this procedure might suggest. It is well, therefore, that some thought be given to the statement of some of the fundamental conditions which must obtain to insure a good concrete, which is of absolute importance, as well as to realize the largest ultimate factor of economy in operation. These two ends are obtained by the same means, the one depending on the other, for the best concrete is the most economical to handle.

The typical plant consists of a tower with a hoist bucket to take the batch of concrete from the mixer, a receiving hopper with a controllable gate near the top of the tower into which the batch is dumped from the hoist bucket and a series of chutes or troughs which carry the concrete to the forms. The tower is frequently as high as 200 feet, and the line of chutes may carry the concrete as far as 500 feet from the tower and by using a relay tower the concrete may be placed in the forms 1,000 feet from the mixer.

The matter of first importance to the successful operation of the gravity plant as well as of any method of distribution is the condition of the concrete as it is discharged from the mixer. Concrete is in proper condition for the gravity plant when it has been subjected to the action of a well designed mixer long enough to incorporate all of the aggregates thoroughly, the batch being assembled with the proper amount of water to hold the aggregates in suspension, the resultant mixture being a viscous, homogeneous mass. The concrete should not be so dry that it will not level off on top as it stands in the bucket, nor should it be wet enough to show water on top of the bucket if left standing for an appreciable length of time, nor to allow a stone to sink much over its own thickness when placed on top of the mass. Too dry concrete limits unnecessarily the range of distribution from a tower of a given height by requiring a steeper chute to carry it. A wet concrete which allows the heavier aggregates to settle to the bottom will separate in travel and is to be avoided as one of the unpardonable sins. By all means let the concrete be too dry rather than too wet, but there is the right consistency which avoids both extremes. But these problems are problems of mixing, however vitally they may affect the economy of the distributing plant.

If the concrete reaches the chutes as a homogeneous mass the slope of the chutes is not of vital importance. That slope is generally the best which will allow the concrete to flow with the least velocity which will insure its passage, although a vertical drop in a closed pipe is a feature of many installations on important work. Such vertical lines, however, should have baffles every few feet to arrest the drop and the concrete should be distributed at the bottom by means of a horizontal chute whenever possible. The required minimum slope to carry the concrete properly will vary with the character of the aggregates, the average slope for small round gravel being 1 of rise to 3 of run or an angle of about 18 degrees with the horizontal, the slope for 1-inch stone about 1 to $2\frac{3}{4}$ or 20 degrees, for

$1\frac{1}{2}$ -inch stone 1 to $2\frac{1}{2}$ or 22 degrees, and for 2-inch stone 1 to $2\frac{1}{4}$ or 24 degrees with the horizontal. It is better practice on a long line to hang the chutes with a gradually and very slightly increasing grade as they travel toward the lower end, such a grading being less likely to cause an overflow in the chutes than the reverse. The final distributing section which places the concrete in the forms should retard the concrete to as slow a movement as will carry it at all.

In the travel through the chutes the concrete should flow in a constant, uniform stream so far as possible. The man on the tower at the hopper gate is a very important member of the operating crew. An intermittent rush of concrete is apt to congest the chutes, causing overflows, shut downs, the retaining of concrete in the tower hopper for an undesirable length of time and damaged work. The concrete should be delivered by the chute as closely as possible at the point where it is to remain. The final chute section should be easily portable with the mouth close to the forms and the concrete traveling as slowly as it can be made to run.

New Orders for Giant Griffin Mills and Bradley Hercules Mills

The Bradley Pulverizer Company of Allentown, Pa., announces the sale of their Giant Griffin Mills to the Standard Portland Cement Company, Leeds, Ala., and the National Cement Co., Caracas, Venezuela.

They have also secured another order from the Lawrence Portland Cement Co., for a Bradley Hercules Mill. This is in addition to orders they have for shipment to Cuba and South America, both orders received from the Standard Portland Cement Co., and the National Cement Co., of Caracas, Venezuela, are repeat orders, this making the third repeat order from the Standard Portland Cement Co., and the second repeat order from the National Cement Co.

Their London, England, office has also received an order from the Ship Canal Portland Cement Mfrs., Ellesmereport, England, for Giant Griffin Mills, this also being a repeat order.

Speed Reducers and Gears

A piece of equipment which has become standard in a great many cement plants is the spur gear speed reducer made by Foote Bros. Gear & Machine Co., 210 North Carpenter street, Chicago.

This speed reducer is made in any ratio or horsepower to meet the requirements of customers. It is so made that it is not affected by dust or grit, a feature which is of particular interest to cement manufacturers. It costs little to install and maintain and is built for continuous hard service.

The company will be glad to give detailed information to those who are interested, also information on cut gears of all kinds.

New Chicago Office of Stroh Steel Hardening Process

Mr. F. Lloyd Mark has been appointed Western Sales Manager with offices at 728 Monadnock Building, Chicago, of the Stroh Steel-Hardening Process Company of Pittsburgh.

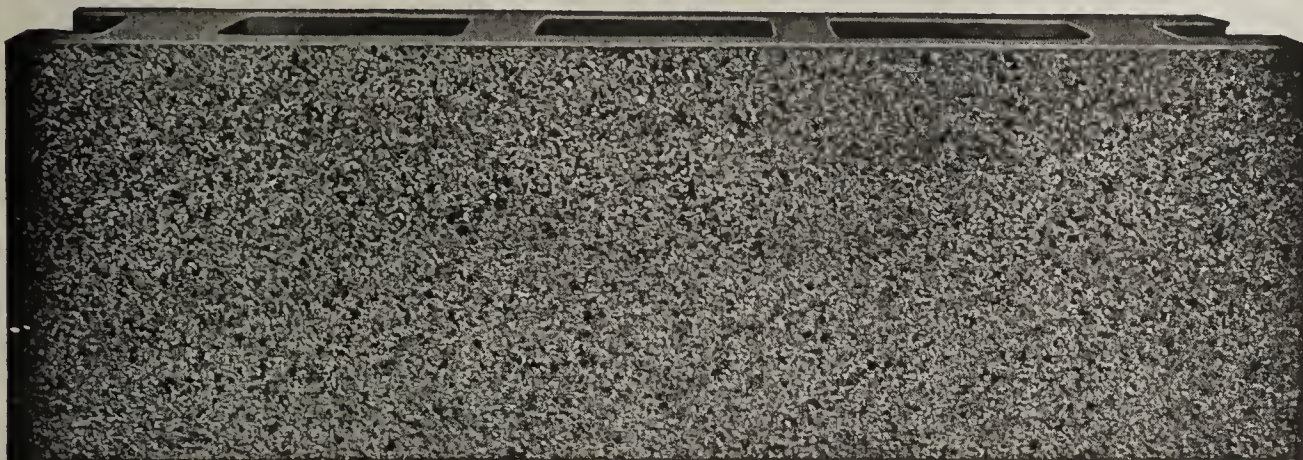
This company's processed steel castings furnish the greatest wear-resistant steel known and are in general use in the steel, cement and mining industries.

The Universal Portland Cement Company's new mill at Duluth is equipped throughout with Stroh process gears and pinions.

Zagelmeyer System

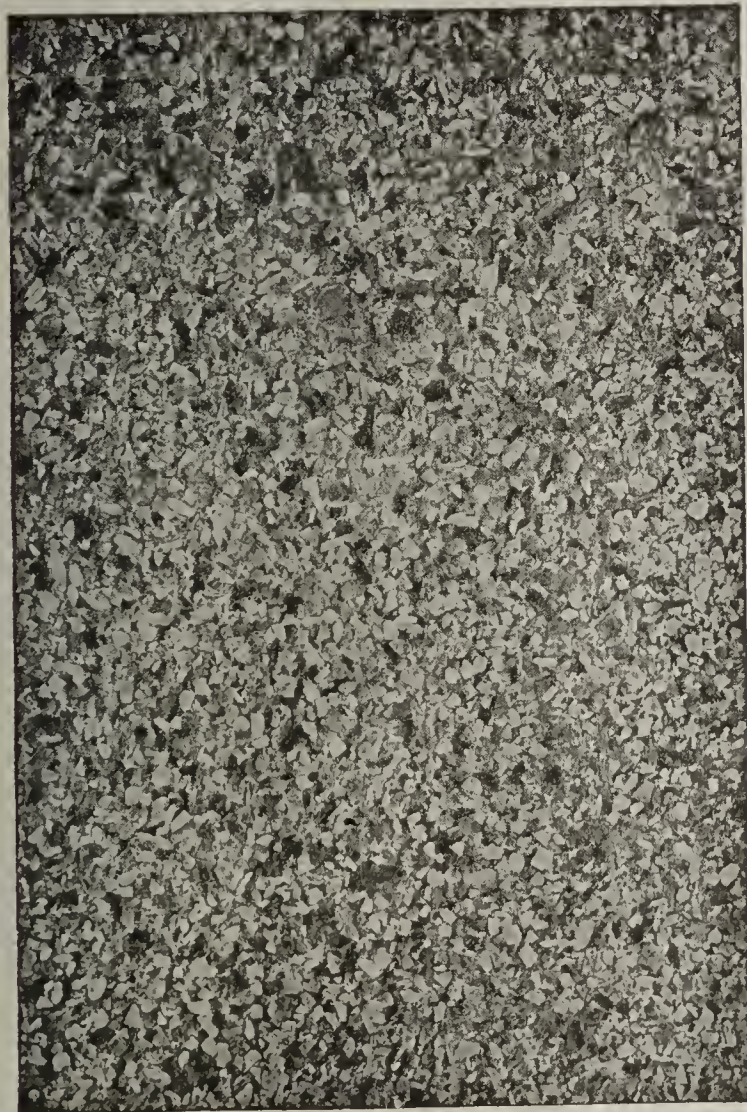
of Casting

Hollow Cement Building Blocks With Granite Faces



8x8x24 inch Granite Smooth Face Block

By a new process, which protects the facing, while the block is being cast, we eliminate all traces of cement from the face of block, and nothing but the GENUINE GRANITE SHOWS IN ALL ITS SPARKLING BEAUTY.



Enlarged View of Granite Smooth Facing

They cost less

They sell for more

You sell more of
them

These cuts show blocks just as they came from the molds; they are not treated with acid or scrubbed with brush or sprayed.

We challenge the whole world to show us a cement block made by any other system, at any cost, that equals these blocks for beauty, strength, quality or imperviousness to heat, cold or moisture.



8x8x24 inch Granite Rock Face Block

Send us fifty cents and we will send, freight prepaid, to any point in the United States, east of the Mississippi and north of the Ohio Rivers, a granite-faced block, one-half rock-faced and one-half plain-faced. YOU WILL SAY WHEN YOU GET IT THAT YOU NEVER SAW A CEMENT BLOCK BEFORE.

They are positively cheaper to make than the ordinary dry-tamp, sand-faced block.

MR. BLOCK MAKER:—

What show will you have if your competitor secures the exclusive right for this system in your city?

Send for a catalog fully describing our system and showing our multiple molds mounted on trucks, for casting hollow cement building blocks.

Zagelmeyer Cast Stone Block Machinery Co.

25 Crump Avenue, BAY CITY, MICH.

Concrete Septic Tanks for Country Houses

The most efficient disposal of sewage without a regular sewer system remained a problem until the concrete septic tank was invented.

While the odor from a septic tank is scarcely noticeable, it is nevertheless best to locate it at some distance from the house. Choose a spot easy to excavate so that the top of the tank can be sunk 6" below ground level and where the lines of drain tile will have sufficient fall to carry off the discharged fluid. The tank should be large enough to hold the entire sewage for one day. For a family of eight people to ten people occupying a house having two bathrooms fitted with the customary appliances in the way of tubs and sta-

of concrete in the bottom of the pit to form the floor of the tank. On top of this concrete set the box forms, which should be ready for immediate use. Place the forms so that there is a space of 6" between them and an 8-in. space between them and the earthen walls of the pit. Then begin depositing the concrete for the walls and partition. As soon as the level of the concrete reaches the holes in the forms place in the holes 6-in. pipes as illustrated. Then continue the concreting until even with the top of the forms.

Two ordinary iron manhole frames and covers may be obtained from a local dealer in building supplies. The manhole covers should fit tightly and should not be perforated. The manhole frames should be 10" high so that when placed on top of the forms the upper edge will be even with the

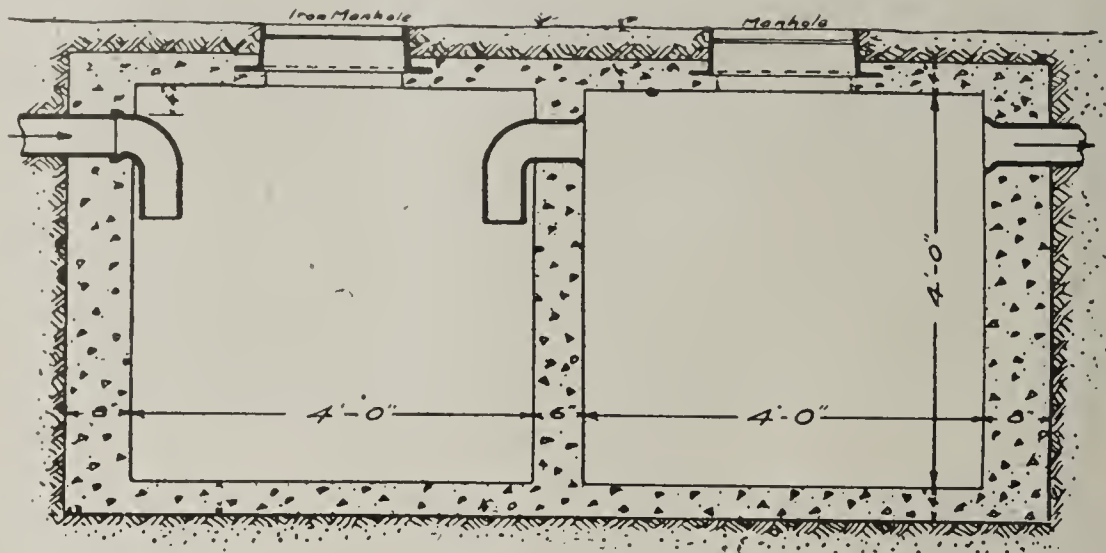


FIG. 1—CROSS-SECTION INDICATING LOCATION OF PIPES

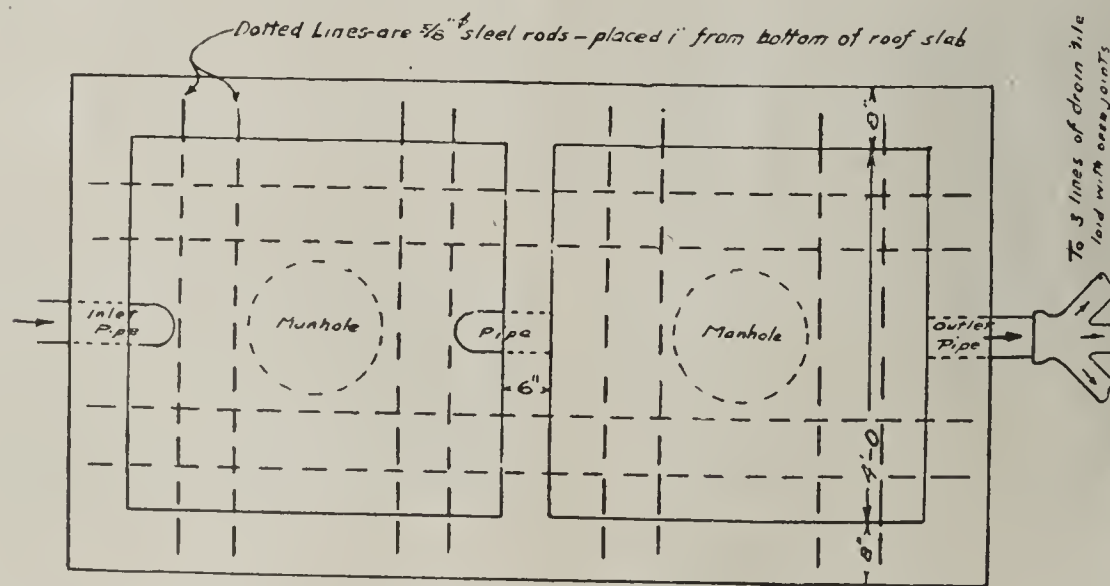


FIG. 2—PLAN SHOWING PROPER POSITION OF REINFORCING RODS

tionary washstands and downstairs the kitchen sink, a concrete tank having two compartments, each 4' long x 4' wide x 4' high, will be required. Since the top and the bottom are each 4" thick and the top of the tank is 6" below ground level, dig the pit 5' 2" in depth. The walls of the tank are 8" thick and the partition between the two compartments 6". Therefore, the length of the pit should be 9' 10" and the width 5' 4".

If the earthen walls of the pit stand firm inside forms only will be needed. These inside forms are merely boxes made of 1-in. boards. Two boxes will be required to make two apartments. The outside dimensions of the boxes should be 4' x 4' x 4' high. The boxes or forms will be placed on the freshly laid concrete floor. Holes for taking 6-in. pipe should be made in the boxes as shown in Fig. 1. The holes should be 4" from the top of the box form, measuring from the top of the hole. The concrete should be mixed in the proportions, should be mixed in the 2 parts sand and 4 parts crushed rock or gravel. Place a 4-in. thickness

ground level. If the manhole frame is of less height than this, it should rest on a circular piece of 1-in. board, which is nailed to the top of the form. Since the concrete roof is to be self-supporting, it will be necessary to reinforce it with a few lengths of $\frac{3}{8}$ -in. round steel rods. There will be needed four pieces of $\frac{3}{8}$ -in. rods, 9' 6" long, and eight pieces 5' long. The roof is now ready to be placed. Place the manhole frames in proper position on top of the form, and deposit the concrete to a depth of 1 in. and on the concrete lay the long and short bars as shown in Fig. 2. When the bars are placed, deposit the balance of the concrete so as to bring the roof to a total thickness of 4". As it will be covered with earth it is not necessary to give this top surface a smooth finish; merely level the surface by striking off with a straight piece of board. The tank should now be allowed to rest undisturbed for at least two weeks. At the expiration of this time, saw away the wooden top of the forms inside of the manhole frames. Then enter the tank

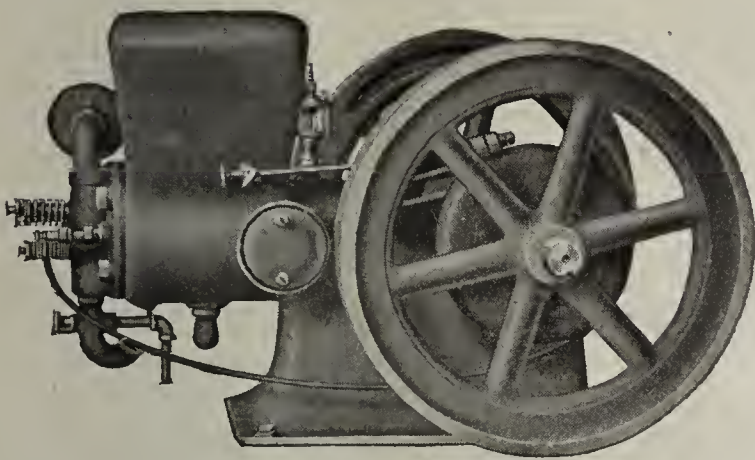
Thompson Plow & Engine Works

Beloit, Wis., U. S. A.

MANUFACTURERS

PAN-AMERICAN GAS ENGINES

Equipped with built-in High Tension Crank Shaft Magneto mounted directly on the Crank Shaft. No Brackets, Gears or Fixtures.



We make a specialty of Home Lighting Plants, Glass sealed jars, fully charged and ready to operate as soon as erected. These superior Lighting Plants in connection with our Pan-American Engines are sold at remarkably low prices which make them within reach of every farmer. It is the modern system.

Thompson Engines are extensively used for operating Concrete Mixers. Safe and reliable.

Write for catalog

BULL FROG Wheelbarrows

UILT OR ORK



"I Am A Champion of Progress"

THE BULLFROG BRAND

We manufacture with this idea only in view
Wheelbarrows, Concrete Carts and Drag Scrapers

The Toledo Wheelbarrow Co.

Chicago Offices and Warehouse
337 River St., Chicago, Ill.

Toledo, Ohio

and remove the wooden forms, passing the lumber out through the manhole opening. While in the tank make certain that the pipes are all unobstructed and not even partially clogged with dirt or lumber. The inlet pipe is then connected to the pipe from the house and the outlet pipe joined to three lines of 3-in. concrete drain tile. The drain tile will be laid about 12 ins. below the surface of the ground and the joints left open, that is to say, no mortar must be used in the joints. This permits the discharged fluids to be absorbed by the surrounding soil. The drain tile lines should be laid in the form of the letter "Y" and sufficiently extended to cover a large area of ground. Average conditions require that each arm be about 100 ft. long. After this is done, cover the tank with earth to the level of the manhole covers. It is now ready for use.

A tank of the size specified will require about 4 cu. yds. of crushed rock, 2 cu. yds. of sand and 7 bbls. of Portland cement. There will also be needed 78' of $\frac{3}{8}$ -in. round steel rods, which can be obtained from the local blacksmith or hardware dealer. The tank can be built without skilled labor. It requires but few tools and construction methods are so simple that one man can easily build it.

*From information furnished by the Portland Cement Association, Chicago.

The Silo is Calling You

If your tympanum is not cracked, and you care a chicken's kick about listening to what is going on, you can surely hear the call of the silo, like the birds hear the call of spring, or the cooped-up city people hear the call of the wild at this delightful season. To the farmer, the silo is the watch-tower of prosperity; to the cement man, it is the sign and symbol of golden opportunity.

Just consider for a moment the number of farms there are in this country—about six and one-half million. Think what this would mean for the silo builder if the owner of each one of these farms should decide to build only one silo—and many of them need two or three. The volume of business would be enormous; it would also be secure, undisturbed by war's alarms. True, the great profits of this construction business would be divided by the number of the states, and probably also by a fraction of the number of counties in a state—for no man could handle more than a limited territory—but even so, it would make many a cement contractor rich; and the wide-awake, progressive cement man will not let the opportunity slip.

The number of silos in use is a pretty good barometer of the agricultural progressiveness of a state. Among the various states, Wisconsin is far ahead in the use of silos, there now being 53,000 in that state, which has a total of 177,127 farms. Illinois ranks next with 24,500 silos and 251,872 farms; while Iowa follows close with 20,150 silos and 217,044 farms. Missouri would seem to furnish the most fertile field for the introduction of silos, as it is credited with 277,244 farms, though Ohio follows closely with 272,045, Illinois and Iowa coming next, then Indiana, with 215,485 farms, and Michigan with 206,960 farms. In the use of silos, Ohio, Indiana, Michigan, Missouri, and Kansas are all ahead of Nebraska, which stands eleventh on the list, with 129,678 farms, and as yet only 4,500 silos. The Nebraska field for the silo builder is therefore one of special promise, as the farmers there are already awakened to a realization of the value of the silo method of storing feed for live stock.

Mr. Cement Man, it will be well to study the opportunity here presented. Write to the manufacturers of silo forms, and let them explain how they can start you in a profitable business.

Air-Insulated Concrete Chimneys

The Multiplex System of ventilated chimney flue construction, for which molding machines are made and sold by the Multiplex Concrete Machinery Co. of Elmore, Ohio, has unique features that specially commend it to the practical chimney builder and the up-to-date ventilating engineer.

In the first place, the flue opening is round, which insures greatest efficiency of draft because of total absence of dead air space. This obviates the tendency to clog with soot or creosote.

Almost entirely surrounding the round flue is an air space, leading into which are openings in the outer block wall wherein registers may be placed for ventilating rooms from basement to uppermost story, without interfering with the smoke draft in the slightest. The air in this ventilating space is warmed by the heat of the flue, thus increasing the draft for ven-



Multiplex Chimney Block Machine.

tilating purposes. The insulation of the interior flue makes the chimney fireproof; and this machine is claimed to be the only one on the market which combines these two features of fireproof insulation of flue and ventilating chamber to carry off foul air and odors from basement and rooms. Write the Multiplex Company for their catalog No. 10 and mention Cement News.

Concrete Roads

Washington County, Miss., has advertised for bids on 100 miles of concrete roads. There is still some doubt in the minds of the local officials as to whether to build about 140 miles of 9-foot concrete with gravel shoulders or 157 miles of concrete without gravel shoulders but with gravel turnout at suitable intervals.



Common Sense

IT is common sense for a concrete contractor who is tired of an *Odd-Jobs* concrete business, to make a thorough investigation of the better lines of concrete work.

The erection of monolithic concrete grain storage, water tanks, coal pockets, and silos is known to be the best of the better-paying lines.

Then why not ask us about the POLK SYSTEM of circular monolithic concrete construction and the good business it brings?

A post card will do.

Polk Genung Polk Company

Fort Branch, Indiana

EXHIBIT →

Insurance Exchange Building (2nd floor)
175 West Jackson Boulevard CHICAGO

"Paper Sacks"

We desire to call attention to
our manufacture of

"All-Rope" Paper Sacks

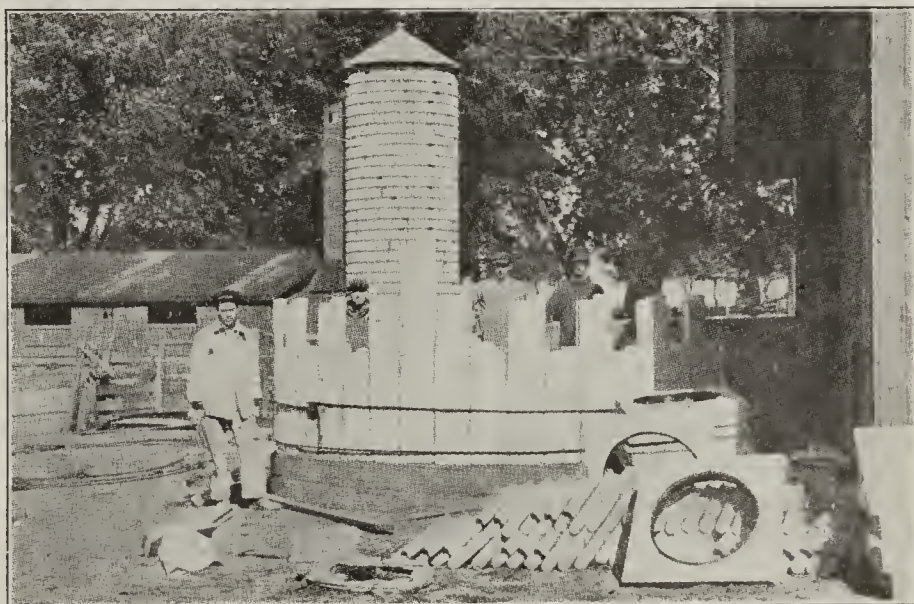
For Cement, Plaster, Lime,
Sand, Etc.

They are known to be the very
best, and consequently the most
satisfactory "Paper" sack made.

Write us for samples and prices.
We will appreciate it.

**The Chatfield & Woods
Sack Co.**

CINCINNATI :: :: OHIO



HERE'S a chance to get into the silo business and to keep the profits where they belong—in your own pocket.

You can start into this business without a great expense if you select the right system. We can start you on the "right system."

Buy a set of Caldwell molds and make Silo Staves as you make building blocks. No royalty to pay. No territory to buy. We sell the outfit without strings attached to it. This is a good proposition and it will mean money to you.

Caldwell Stave Silos are permanent because each unit is made of poured, reinforced concrete, each unit interlocks with the six adjoining staves and each unit is crossed by three steel bands, resulting in a storm-proof, water-proof, air-proof, acid-proof, fire-proof silo that you can sell.

The most businesslike silo proposition on the market will be sent free on request. Write today for an outline of our system.

Co-operative Concrete Construction Co.
OSKALOOSA, IOWA

Colored Concrete Surfaces

The most satisfactory concrete surface of a given color and texture is obtained by properly finishing a surface faced with a mixture composed of cement and an aggregate of the proper size and color. Such a surface may be considered as permanent, will not deteriorate, scale, fade or require renewing. When aggregates of the required color are not available, or for any reason it is not possible to obtain a surface of the desired color in this manner, satisfactory results may be obtained by what might be termed body coloring and surface coloring.

In body coloring the coloring matter is thoroughly mixed with the materials used in the facing mixture, thereby producing a facing of a uniform color for its entire thickness. The color matter can be used either in a dry form or as a paste. When used dry the most satisfactory results are apparently obtained when the coloring matter is first thoroughly mixed dry with the cement, and this mixture mixed dry with the aggregate before adding any water. Some prefer, however, to mix all the materials together dry in one operation, while others prefer to add the coloring matter to the mixing water.

The ingredients of cement have a strong and generally injurious chemical action upon most of the ordinary pigments. Those of vegetable origin are most susceptible to this action and for this reason for body coloring only mineral colors should be used. Owing to the danger of impairing the strength of the mixture, only a limited amount of coloring matter can be safely used, and it is better to obtain the desired shade by the use of a small amount of a strong though high priced color rather than by the use of a large quantity of a cheap, weak coloring matter. About 5% by weight (of the weight of the cement) is maximum amount of coloring matter than can be safely used. Owing to the fact that the number of pigments available is limited, and that but small amounts of these can be used, the different colors and shades to be obtained by body coloring are comparatively limited. The following table taken from "Cement and Concrete," by L. C. Sabin, shows the colors obtained by the addition of various amounts of different coloring materials:

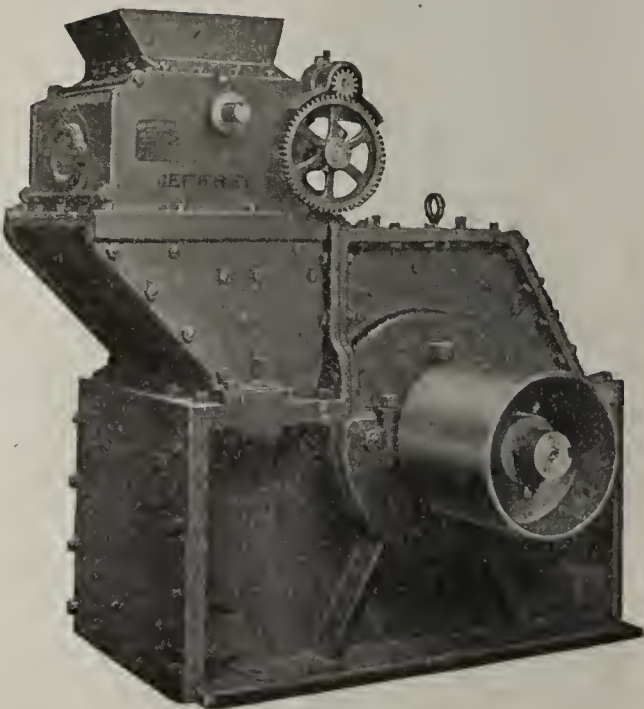
In surface coloring the coloring material is applied as a thin film or coating on the surface after the con-

crete has hardened. The results to be obtained with ordinary oil paints when used in this manner are questionable and they should not be used upon concrete surfaces, but there are a number of specially prepared paints, cement stains and cement coatings on the market that apparently give splendid satisfaction.

Jeffrey Machine for Fine Grinding of Limestone

Bearing troubles are unknown to users of the Jeffrey Swing Hammer Pulverizer, shown herewith. This machine is for fine grinding of limestone and similar rock. The cut shows method of feeding and impact crushing.

The Ball Bearings (an exclusive feature of this machine) permit of high rotative speed—require minimum lubrication and attention. Easily accessible. The hammers of manganese steel, double ended, offer re-



Jeffrey Pulverizer.

sistance to abrasive materials, and are easily removed or replaced through door in the front of machine.

Jeffrey Manufacturing Co., 914 North Fourth street, Columbus, O., will gladly send you a copy of Bulletin No. 147-14, giving full particulars of their entire line of swing hammer pulverizers.

COLORED MORTARS

Colors Given to Portland Cement Mortars Containing Two Parts River Sand to One Cement

Dry Material Used	Weight of Dry Coloring Matter to 100 Lbs. Cement				Cost of Coloring Matter per Pound (cents)
	½ Pound	1 Pound	2 Pounds	4 Pounds	
Lamp Black.....	Light Slate.....	Light Gray.....	Blue Gray.....	Dark Blue Slate....	15
Prussian Blue.....	Light Green Slate..	Light Blue Slate...	Blue Slate.....	Bright Blue Slate...	50
Ultra Marine Blue.....	.....	Light Blue Slate...	Blue Slate.....	Bright Blue Slate...	20
Yellow Ochre.....	Light Green.....	.....	.....	Light Buff.....	3
Burnt Umber.....	Light Pinkish Slate.	Pinkish Slate.....	Dull Lavender Pink.	Chocolate	10
Venetian Red.....	Slate, Pink Tinge..	Bright Pinkish Slate	Light Dull Pink....	Dull Pink.....	2½
Chattanooga Iron Ore	Light Pinkish Slate.	Dull Pink.....	Light Terra Cotta..	Light Brick Red....	2
Red Iron Ore.....	Pinkish Slate.....	Dull Pink.....	Terra Cotta.....	Light Brick Red....	2½

The Roof for All Time

Start a
"Concretile"
Plant



The Greatest
Opportunity in the
Construction Field

The most economical, attractive, permanent fireproof roofing in existence. A standard roofing in Germany for more than 25 years.

The manufacture of Walter Concretile is now a national industry in this country. Within the last eighteen months large plants have been established in many of the leading cities. All operating plants have business booked ahead—the demand is universal.

We Do Not Sell Blue Sky

We sell complete equipment for starting business. We protect you in the territory by establishing only one plant in a locality.

Send today for free booklet giving full information.

Walter Concrete Machinery Company

418 Saks Building

State Representatives Wanted

Indianapolis, Ind., U. S. A.

The Multiplex Double Stripper Block Machine makes two Hollow Plain or Rock Faced Block of Wet Mixture at ONE OPERATION



Here is a machine that cuts down the cost of making your building block. In making plain faced block the machine handles a wet mixture and stripping the block out it trowels the sides. The wet mixture compacted under pressure from *both top and bottom*, produces a strong waterproof block which is easily cured. A 150-lb. man on the end of the lever will exert a 40-ton pressure on the block. Two men will make from 700 to 800 blocks per day on this machine.

Write for our latest printed matter explaining the operation of this labor-saving machine in detail

Write for catalog No. 10 and mention Cement News
The Multiplex Concrete Machinery Co., Elmore, Ohio

Same Machine Makes Chimney Block

The Multiplex Stripper may be equipped for manufacturing chimney block as well as building block. Note the flue block shown here with the round smoke chamber in the center, the ventilating chambers in the corners and the tongue and groove joints insuring rigid construction. There is money in the manufacture of chimney blocks alone.



National Screen Separators

Within the past year the National Engineering Company, of Chicago, has added a No. 5 screen to its line of National Screen Separators. The screen is 12 feet wide, and designed primarily to meet the demand of one of the largest gypsum companies in New York state, and, after installing one of these separators, they have since ordered 8 more.

The National Screen Separator is made not only with one screening surface, but with two, or even three screening surfaces; one or all of them being agitated as may be required. When the No. 5, or 12 feet wide, separator is equipped with three screening surfaces it then has 216 square feet of screening surface.

One of the main features of the National Screen Separator is the elimination of the tendency to clog by the use of a unique method of agitating the wire cloth, and which is obtained by stretching wires beneath the wire cloth, these wires being vibrated with considerable rapidity upward against the under side of the wire cloth, the jar being sufficient to keep the meshes clean, and is caused by depressing the agitating wires and suddenly releasing them. The force and number of the blows may be increased or decreased according to the fineness or coarseness of the wire cloth used, a coarse cloth requiring a slightly heavier impact than a finer cloth.

The separator is designed with sectional screens each 24 inches wide and uniformly 6 feet long. Each section is provided with three agitating wires. One of the rock shafts vibrates the wire located in the middle of the section, alternating with the other rock shaft which vibrates the other two wires of each section. Thus the central wire, serving as a reinforcing support

to the screen panel, is at rest while the two outer wires are in vibration, and vice versa.

The regulation and adjustment of the mechanism permits not only an increase or decrease of the number of blows on the agitating wires, but also permits a blow as light as a mere tremor, or much heavier blows necessary for heavier material.

The agitating wires are snapped at the upper end of the screen and consequently that part of the wire cloth receives slightly more vibration than the lower end. But it is at the point of greatest vibration that the material falls from the distributor onto the screen, and where clogging usually gives the most trouble. Thin strips of steel fastened to the bottom side of the wire cloth protect it from wear due to the snapping action of the agitators.

The mechanism for producing and adjusting the agitation of the vibrators is concealed in a small dust-proof box at one end of the distributing box. The distributor is equipped so as to distribute the material evenly along the entire width of the screen.

The National Screen Separators, numbering from 1 to 5, are made in widths of 4, 6, 8, 10 and 12 feet.

The National Screen Separators are manufactured by the National Engineering Company, 5 North La Salle street, Chicago, who will be glad to send prospective customers literature which fully describes and illustrates the machine.

Tycrete Waterproofing Compound

Tycrete Concentrated Compound, manufactured by the Ideal Concrete Machinery Company, 1353 Monmouth ave., Cincinnati, Ohio, is primarily a waterproofing for concrete. It will absolutely water-proof all kinds of concrete work—monolithic concrete, cement mortar or concrete blocks.

This is done by natural means. That is, by making the concrete harder and more dense. It has no injurious effects upon the quality of the concrete, as do some waterproofing preparations, but instead actually makes it stronger and better.

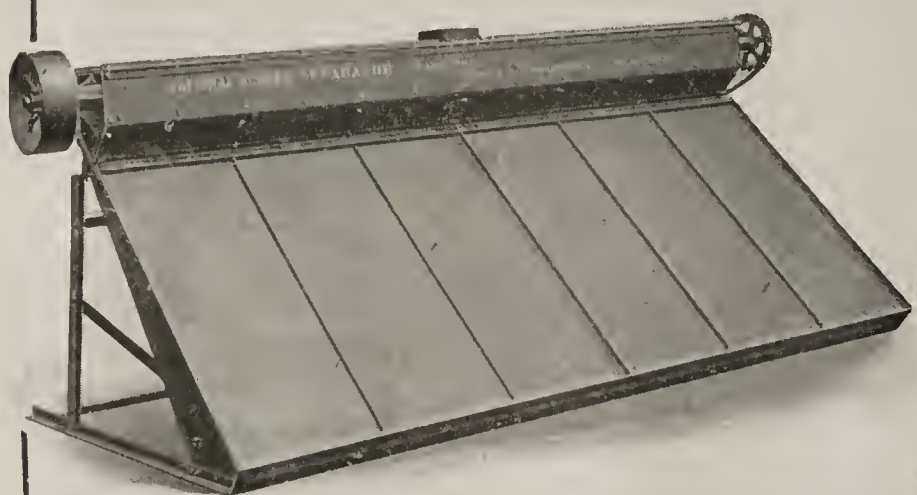
Owing to its highly concentrated nature, it can only be diluted in boiling water, therefore Tycrete Concentrated Compound is not affected by exposure to the weather or acid fumes.

Tycrete Concentrated Compound is shipped in 50 and 100 pound drums. It makes a very reasonably priced waterproofing, as one pound of diluted Tycrete is sufficient to waterproof about thirty-eight 8x8x16-inch concrete blocks.

Concrete products manufacturers who aim to secure the approval of architects for their products should get a drum of Tycrete Concentrated Compound and manufacture a few first-class, absolutely waterproof blocks with it, then go after the local architects, show them the superior qualities of Tycrete products and get them to specify their use. Architects who have hesitated in using concrete blocks before will gladly recommend Tycrete products after seeing their superior qualities.

Tycrete Concentrated Compound is a caky substance and must be diluted in water by boiling before it can be used. For facing factory-made concrete products, such as concrete blocks, ornamental and dimension stone, use five-eighths of a pound of Tycrete Concentrated Compound to each gallon of water. For slush concrete work use one-fourth of a pound to each gallon of water. This should be heated until the compound is entirely dissolved. Stir constantly to secure perfect dissolution. The mixture should be permitted to come to a boil. When the compound is entirely dissolved, allow the mixture to cool, after which it is ready for use. The diluted Tycrete Compound prepared as above

National Screen Separator



No. 5. National Screen Separator 12 ft. wide.

Gives Positive Results and Greatest Efficiency

Built in four sizes, 4, 6, 8 and 12 ft. wide.

Other special features to consider are as follows:

- Simplest and most substantial construction.
- Economical operation.
- No mechanism on lid or cover.
- Can examine the separator while in operation.
- Abundant references from the largest concerns.

Write for catalog and prices

NATIONAL ENGINEERING CO.

5 N. La Salle Street

CHICAGO

should be used for tempering the concrete in place of ordinary water. A stock of the diluted Tycrete Compound should always be kept on hand, as when thoroughly dissolved it remains in condition for use at least one week.

When using the diluted compound for wetting the facing of concrete blocks, make the facing just as wet as it can be used in the block machine. Write the Ideal Company for their new waterproofing catalog.

Tycrete Colors (Dry)

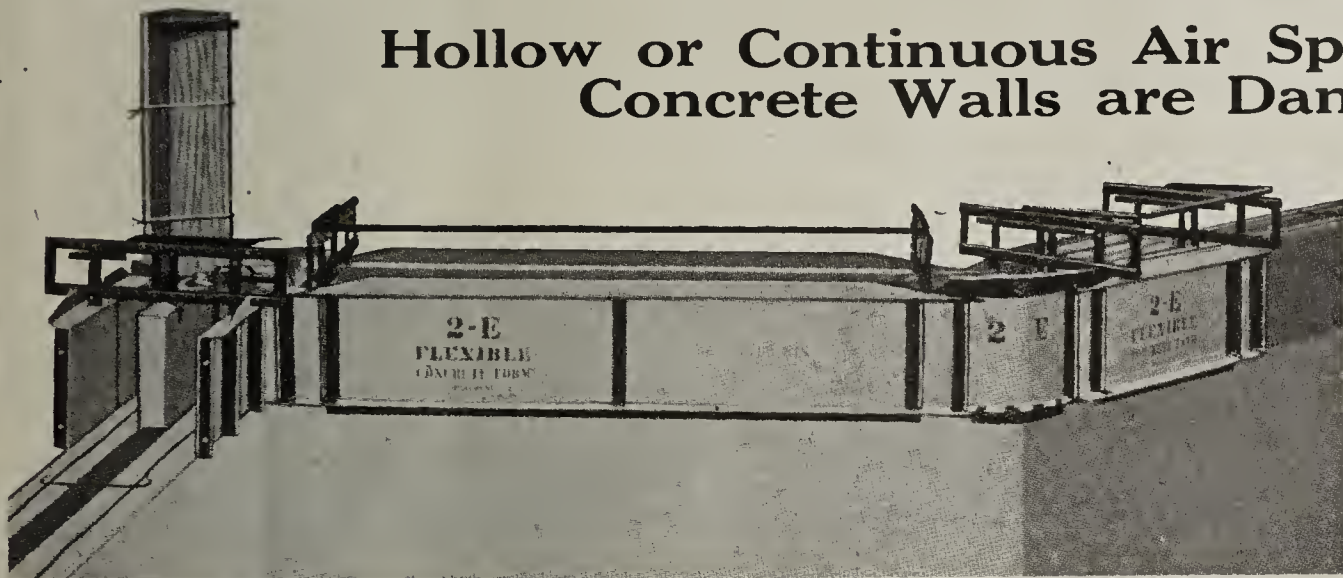
Tycrete colors are specially prepared under our secret formula for use with Tycrete Concentrated Waterproofing Compound, writes the Ideal Concrete Machinery Company, 1353 Monmouth avenue, Cincinnati, O. Ordinarily it is not safe to use over ten per cent of coloring with Portland cement, but with Tycrete Concentrated Compound and Tycrete Colors

we have succeeded in using as high as twenty per cent coloring with satisfactory results. The amount of coloring to be used depends on the shades desired. For deep colors, it is necessary to use more coloring than for the lighter shades. Tycrete Colors are shipped in 25-pound cans and larger sizes.

Boss Contractors' Machinery

The American Cement Machine Co., 9365 Johnson street, Keokuk, Iowa, has issued Catalog No. 17 descriptive of the Boss line of concrete mixers, grouters, parers, contractors' hoists, backfillers and diaphragm, rotary and force pumps. Special attention is drawn to the use of Hyatt self-oiling roller bearings on all the machines.

Hollow or Continuous Air Space Monolithic Concrete Walls are Damp Proof



2-E Equipment

makes possible the construction of concrete homes that are absolutely fire and damp-proof, at a cost not to exceed wood construction.

Send for our free trial offer.

2-E Flexible Concrete Forms

692 Centre St., EAGLE, WISCONSIN

The Rugged Ruggles

AERIAL CARRIER



Suspended over Slate Quarry

SELF DUMP BRAKING LOCK

Built in Two Sizes:—1 to 5 tons capacity, 5 to 10 tons capacity.

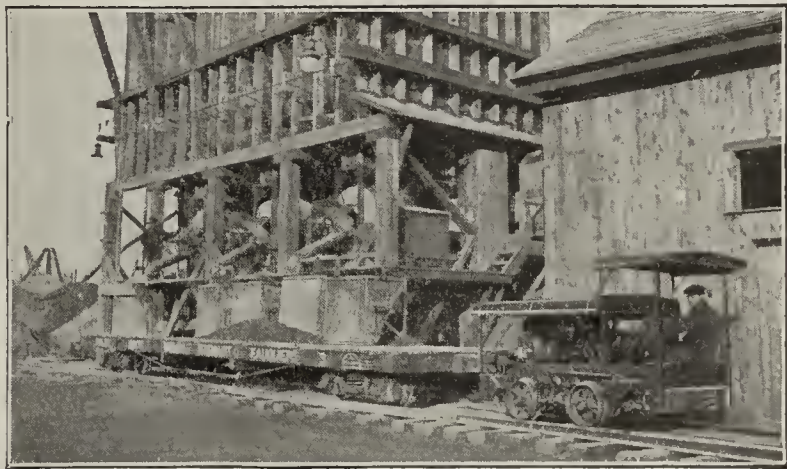
The **Rugged Ruggles** is made for special use on cement and gravel construction work. For all kinds of quarries where the waste is taken from the pit and dumped at the surface. It will take any load up to ten tons, from any depth to the cable, where it is automatically released and sent either up or down the cable and dumped in mid-air or lowered. One man can operate three **Rugged Ruggles** on as many cables with a three-drum engine:

No brake to wear the cable—Can run on a flat cable.

Simple in construction; made entirely of steel; all the sheaves steel bushed or brass, and is backed by years of extensive use.

Manufactured by

Ruggles Machine Co., POULTNEY VERMONT Dept. C



The Plymouth Hauling Concrete for Foley Bros., Welch, Stewart & Fauquier.

"Saves Yard Haulage in Contract Work"

—Says McArthur

Foley Bros., Welch, Stewart & Fauquier, general contractors, Halifax, N. S., have two Plymouths employed constantly in general yard switching and hauling concrete on the job. C. D. McArthur, chief engineer for this firm found, that—

The Plymouth

Friction-Drive Gasoline Locomotive

1—It costs less to buy. 2—It costs less to install. 3—It costs less to operate. 4—It costs less to maintain. 5—It takes heavier loads up grade. 6—It uses full power of motor in high or low speed and moves quicker without jerk or jar.

Chief Engineer McArthur Writes This:

"These Plymouth Locomotives are entirely satisfactory to us. We find them of great help in our yard work and we find it would be hard work to get along without them."

Get This Book We have just issued a new book for Contractors, Clay-workers, Manufacturers, Miners and others with haulage problems. It tells all about the work of The Plymouth for this Nova Scotia firm and of many other owners of Plymouths. It also gives complete description, cost data and other valuable information regarding haulage problems similar to your own. A copy is yours for the asking. Send for it today.

THE J. D. FATE COMPANY

220 Riggs Avenue

PLYMOUTH, OHIO



Get into the Burial Vault Business

In every town and county in this country there is a big, glowing opportunity for a live man with some capital, some business ability and a lot of energy to found a permanent, profitable business manufacturing the Chicago (Janisch Method) concrete burial vault—for which there is a national demand. No Royalties; Never a Failure. Costs less to make than others, therefore more profit.

It doesn't cost much to start in this business, and it's steady the year around. Write today for our catalog.

Chicago Cement Burial Vault and Casket Company

5301 RAVENSWOOD AVE.

CHICAGO



Winter

Doesn't Stop the Sealing Vault Business

There is a constant demand the year round. A demand that you can supply with just one set of our Steel Molds. Think how nice it would be to have a neat little income during the winter months and all the year round.

The AUTOMATIC SEALING VAULT

pay big profits from fifteen to 24 dollars on each one. You can develop this as a side line or devote all your time to it. Make the dollars come in this winter by making the AUTOMATIC SEALING VAULT.

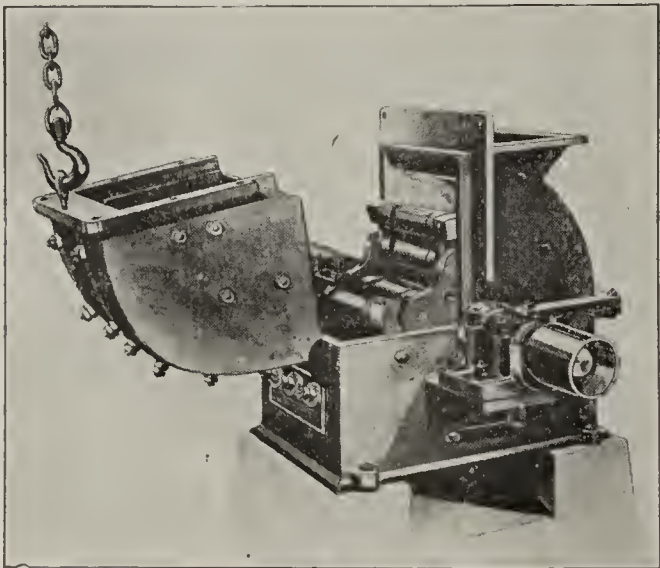
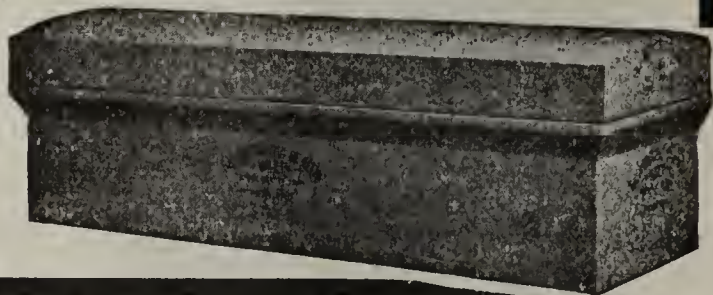
The First Step is to send for information. We'll furnish full details and particulars. Write Today.

The Automatic Sealing Vault Co.

216 East River Street

Peru, Ind.

The Fin-
ished
Vault



The Brainard Made in Four Sizes

A crusher as well as a pulverizer. Easily accessible and works upon the IMPACT principal, while the material is in suspension, requiring no adjustment to maintain capacity or size of product.

Number or size	Largest size feed	Capacity tons per hour	H. P. required	Approx. weight
0	4 x 4"	2 to 8	6 to 8	1600
1	4 x 8"	3 to 15	10 to 12	2600
2	6 x 12"	8 to 35	20 to 22	5800
3	10 x 20"	20 to 100	40 to 50	17000

Also a full line of Brainard Universal Jaw Crushers, Elevators, Screens, and power transmission equipment.

Send for Catalogue Matter

Mechanical, Metallurgical and Mining Engineering. Special attention given to the design and erection of metallurgical plants of all kinds, also cement and crushing plants and quartz mills.

MIDLAND CRUSHER PULVERIZER CO.

37 W. Van Buren St., Chicago, Ill.

CONCRETE PORCHES

ATTRACTIVE
EVERLASTING
INEXPENSIVE
EASY SELLING



Made with Dunn Molds

Concrete porches are always in demand; pay a big profit to contractors. An outfit of Dunn Porch Molds will make all blocks shown in illustration. Same blocks will also build Chimneys, Posts, Piers, Ornamental Fences, etc. Entire outfit costs very little. Write for Ornamental Mold bulletin.

W. E. Dunn Mfg. Co.
414 24th St., Holland, Mich.

MOLDS SOLD ON 15 DAYS' TRIAL.

Concrete Plants, Contractors, Etc.

Secure our confidential processes, methods and formulas and make concrete marble granites, sanitary flooring, etc., and make money.

Write for details

ART STONE CO.

Box 330

Waynesboro, Pa.



Second Largest Concrete Building Erected

Two Units of Hoboken Water Terminal Containing 660,000
Square Feet of Floor—Built Between June 6 and
October 31 with One Set of Forms

Working single shift, without Sunday or holiday labor, and using but two mixers and a single set of forms above the first floor, the Turner Construction Company completed, between June 6 and Oct. 31 last, two units of a reinforced-concrete structure on the Hoboken waterfront of New York harbor containing 660,000 sq. ft. of slab, exclusive of the basement floor. A special set of panel forms was used for the basement walls and first floor slab, which is of the mushroom type, but for all floors above the first, these being of beam and girder construction, a single set of forms sufficed. For a good portion of the time after the work was well under way progress averaged a floor a week. One entire floor containing 55,000 sq. ft. of slab was completed in 4½ days. Concreting progressed from the twin towers outward, the forms being removed below and re-erected above a few bays at a time. The buildings are almost entirely of concrete, no brick or flooring and very little tile being required. On this account, and because of the location at a rail-water terminal, the problem of delivering and handling materials was simplified.

Building One of Largest in Country

The building is located above Fourteenth Street and in line with Washington Street in Hoboken, N. J., on the south side of a slip leading to the Hudson River just north of the Fourteenth Street (Hoboken) ferry house. When completed it will be in the shape of a U, with the long axis parallel to the slip. The building will be divided by concrete fire walls into four independent sections, each rented to a different tenant. Two of these sections, comprising half of the base and all of that leg of the U next the slip, compose the structure which was completed within the time mentioned. The first portion of the building to be constructed adjoins the east end of the part just completed

and forms the south part of the base of the U and the east part of its southern leg. This structure, built by the same contractor, was completed between June 4 and Sept. 15, 1915.

The portion of the structure at present completed, comprising these three units, is said to form the second largest reinforced-concrete building yet erected, being exceeded only by one of the Bush Terminal buildings in Brooklyn, N. Y.

Unusual Story Height Adopted

The three units, taken together on the basis of cubic contents, perhaps form one of the largest buildings in the country because of the unusual story height of 14 ft. 6 in. This story height was selected because the owners were desirous of having an exceptionally well-lighted structure. Moreover, the building will be occupied by manufacturing concerns using a great deal of overhead shafting for the transmission of power. Provision for securing the hangers for this shafting to the floorbeams was made during the construction of the building by placing short lengths of ¾-in. pipe across the beam boxes at the proper intervals and concreting them in. These pipes were inserted at such a height as to bring them about 2 in. below the finished ceiling. A bolt is passed through each pipe which clamps a pair of hangers, one on each side of the beam.

The exterior walls, all the stairways and the skylight framing are of reinforced concrete. The stair wells are surrounded by partitions of hollow tile. The fire walls between sections of the building, however, are of concrete. The windows are of steel sash, glazed with wire glass.

One Derrick for Two Concrete Plants

The building is founded on wood piles averaging 40 ft. in length. Those for the section erected in 1915, known as building D, were driven during the spring of

that year. Those for sections E and F, erected last summer, were driven at the convenience of the contractor, after the completion of building D and before the beginning of warm weather last spring. Most of this work was done with land drivers, only a few rows of piles next the slip, which support the new dock, requiring the use of a floating machine.

In constructing section D a single concrete mixer and tower located on the north side of the building had been used. This plant was supplied with aggregate by a pair of cars running on a double narrow-gauge track to hoppers set on the south side of the slip. The cars were operated by a hoisting engine and the bins filled with material from barges by a derrick and grab bucket. During the winter this plant was moved west to a location on the slip and another mixer and hoisting tower were added to it. In its new position the enlarged plant was symmetrical about the center line of the fire wall separating the units E and F of the building. One 1½-yd. Smith mixer and one hoisting tower were thus provided for each section. As will be seen from the layout drawing, the towers were directly south of the new bins in this location. The tracks for the swivel dump cars which supplied the mixers were thus very short and the cars could be operated by hand. By securing a thoroughly competent hoisting engineer, the one derrick with a 1½-yd. bucket was able to supply the bins with sufficient material to keep both mixers in operation, though each plant alone frequently poured 400 yd. a day. The operation of the concrete mixers was organized so that there was always one batch in the mixer while a skip of concrete was being hoisted in the tower, one dry batch in the charging hopper of the mixer and one dry batch being drawn into the small car from gates under the material bins.

Piles, reinforcing steel and cement were delivered to the work by rail on sidings located inside the area bounded by the U. A line of gravity rollers was installed from the nearest of these sidings through the building alongside the fire wall above the first-floor level to a point opposite the mixers at the level of the charging platforms. Cement was unloaded from box cars in this way and conveyed to the mixers. In addition, a storage capacity of several cars was provided in building E at the first-floor level.

The reinforcing steel was bent and stored on the south side of the building. An additional tower was located near the center of the south side of the section. On the corners of this were mounted two booms used to hoist the reinforcing to the desired floor. The tower also contained a cage large enough to hold two buggies. This cage was used to hoist the tile. The men, however, used the stairways throughout the job in spite of the unusual height, a total climb of more than 190 ft. from the ground being necessary to reach the roof.

Work on the concrete forms began with a full force of carpenters about a month before time for concreting. All the forms were of wood except the Blaw forms for the round interior columns. The flat-slab forms for the first-floor and basement walls were completed first, and while these were being poured the single set of forms provided for all floors above the first was finished. A circular motor-driven saw was used in this work.

It was unnecessary to provide more than one set of forms in order to keep the mixers running continuously on account of the large floor area involved. Before the last of one floor had been finished, it would be safe to remove forms from the first portion poured. The forms were raised and re-erected in irregular-shaped units, which, however, were the same shape and location throughout, and which averaged about nine bays in area. Each floor was begun by pouring the unit ad-

joining the hoisting tower, beginning at the further edges of the unit and taking up the runways for the concrete buggies toward the tower as the work progressed. Next day, when the adjoining section of form was ready, these runways would be replaced on top of the finished section. Work progressed in this way until the far corner of the floor, diagonally opposite the tower, was reached. About 14 wheelers were required in starting a floor. To maintain the same rate of progress as the work reached the far edges of the floor it was necessary to increase the number until 18 buggies were in service.

Stairs Concreted Separately

As the work progressed it was necessary to piece out the form panels on account of the decreasing size of columns and beams. Section E has been leased for a long term to a tenant who will have very light loads on the seventh, eighth and ninth floors. The form panels for this building between the floorbeams had to be considerably enlarged on reaching these floors, and had to be cut down again for the tenth floor.

Practically the only formwork left behind as the main floors were carried up was that for the stairs, of which there are two sets in each section. These were formed and poured one or two floors below the main work. As the concrete towers were carried up, a hopper was left at each floor level into which concrete could be dumped at will by setting the trip at that floor. It was thus possible to deliver concrete at any level for finishing stairs or other small jobs.

Tile partitions around one stair well and around the freight and passenger elevator shafts subdivide each unit into separate halves to reduce the fire hazard. Except for these, all of the floors are open full length and width. On this account, the trim furnished under the general contract was a small quantity compared to the size of the building. All machinery, except that for the heating and lighting plant of the building, is installed by the tenants. The piping and conduits for the steam heat and lighting wires were carried up by the contractor as the forms were stripped from each floor. The pipe was raised to the proper floors by hand with light tackle.

The daily force employed on the building included 78 carpenters, 325 laborers and 14 to 16 lathers, who placed the reinforcing steel in the forms. The building has been constructed for the Hoboken Land & Improvement Company under the direction of Charles Fall, architect, by the Turner Construction Company. The construction has been in charge of Albert Larsen as superintendent.

The Contractor's Equipment

About the first thing which a contractor should consider in going after a job is the amount of equipment which it will require to do the work. An ordinary job may require one or two concrete mixers, hoists, derricks, and the like, while others will require more elaborate machinery.

Catalog No. 17 of the American Cement Machine Company, 9635 Johnson street, Keokuk, Iowa, contains description and illustration of an unusual number of machines especially adaptable for contractor's work. Among other things, we notice mixers, grouters, pavers, hoists, back fillers, pumps, etc. Every contractor who has anything more than a wheelbarrow gang requires some if not all of this equipment, and the above mentioned catalog is especially interesting to those who are going after the larger and better paying jobs. The catalog will be sent free to our readers on request, and it cannot fail to be interesting and instructive.



Concrete Dam Near Three Rivers, Mich., Designed and Built by Geo. B. Jackson, Engineer, Chicago, Ill.

Concrete Dam

Reinforced concrete is being employed in practically every class of construction, and in many instances is proving to be a more suitable material than any other. During recent years it has been successfully used in the construction of many dams of various sizes. In some it has been used in connection with massive masonry and in others in the usual mixture of cement, sand and small stone.

A type of dam that has been successfully used for low heads on the rivers of southern Michigan is illustrated on this page. These dams are used to develop power for the operation of electrical generating plants, both for commercial and private use.

During times of high water it is frequently the case that the water is several feet higher than the crest of the dam, and there is danger of washing away the river bed below the dam, which might result in serious damage to the structure. To avoid this, the down-stream face of the dam is curved as shown in the illustration on this page. At the bottom this curve is turned up so that the falling water is given a direction parallel to the surface of the stream and the force of the fall is turned up and away from the river bottom.

During certain seasons of the year the flow of water in these rivers is very small, and to maintain an ample head of water for the continuous operation of the power plants some means of conserving the water supply must be adopted. The dams described here are arranged so that the height may be increased by the use of boards fastened in the concrete.

The construction of the dam is monolithic concrete, reinforced with 3-inch mesh expanded metal placed near the down-stream face of the dam. The expanded metal ties the concrete together and prevents cracking. By lapping the sheets of expanded metal the whole fabric becomes for all practical purposes a unit reinforcement extending from end to end of the dam.

Convention of Cement Manufacturers

The spring convention of the Portland Cement Association will be held at the Palace Hotel, San Francisco,



Concrete Dam Near Niles, Mich., Designed and Built by Geo. B. Jackson, Engineer, Chicago, Ill.

April 16-18, inclusive. This will be the first time in the history of the association that any of its meetings have been held west of Chicago. A special train has been arranged for the going trip from Chicago to San Francisco via the Northwestern, Union Pacific and Southern Pacific route. This train will leave Chicago at 8 p. m., Central time, Friday, April 13, and arrive at San Francisco at 9 a. m., Monday, April 16. At the conclusion of the committee and business sessions of the association it is planned that members attending will go in a body to Del Monte, Cal., and spend April 19 and 20 there in an outing.

Concrete Blocks With Granite Facing

The only part of the facing material that you put into a block machine that shows on the block is the surface itself. To make a granite block you have only to provide for granite surface. Why make your facing seven or eight times as thick as you need it? You are multiplying the cost of your facing material seven or eight times when you do that, writes the B. F. Gibler Company, Manston, Wis.

We coat a sheet of paper (for any size of block) with crushed granite. Place the sheet, paper side down, on the face plate, tamp in the wet backing and when the block has set, remove the paper by applying warm water. You will have a granite-face block rivaling natural stone in appearance. You reduce the cost of facing material and the cost of applying it and your block requires no finishing as there is no cement film on the face to be etched off.

Concrete block manufacturers owning their own machine, cost for which is \$18, can manufacture this sheet facing in their own plant at less than $\frac{1}{4}$ cent per sheet, as one ton of granite costing \$3.25 at Crown Point, N. Y., will face 4,500 sheets of 8x16 facing by using our process.

Cloth sheets are used for lining forms for slush work, caps, lintels, dimension stone, stucco or pebble dashing, floors, walls, etc., and full directions for making this granite cloth will be sent with every machine sold.

Mr. Gibler will be glad to send his granite facing machine on ten days' trial.

CEMENT AND ENGINEERING NEWS

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Advertising copy or changes in ads. must be in this office by the 25th of each month, as hereafter our magazine will appear on the 5th of the following month

Advertising Rates Sent on Application

JOHN F. WALDRON - - - - - Advertising Manager

CHICAGO, APRIL, 1917

The Present Cost of Manufacturing Cement

In connection with the advance in the prices of building materials during the last two years, information reaches the public occasionally which indicates that the manufacturer in dealing with labor and raw materials has the vexing problem of high prices before him quite as well as the consumer.

The cement manufacturer today is charging for cement from 20 to 50 cents per barrel more than three or four years ago.

One manufacturer of cement in discussing his difficulties said—"As compared with 1915 cost results for January, 1917, show that coal for power and burning was 25 cents higher per barrel for finished cement. In other words the amount we are obliged to pay for coal now has increased the cost of manufacturing a barrel of cement 25 cents as compared with the early part of 1915. We are paying 35 per cent higher wages which has increased the cost of manufacturing cement several cents per barrel. All repair and renewal material has increased in cost by percentages varying from 30 per cent to 250 per cent. The increase in the cost of insurance due to the general adoption of compensation insurance and the increase in taxes have also added to our cost of doing business 1 cent per barrel. We have been compelled to pay higher salaries. Our operating costs are considerably higher than formerly by reason of frequent interruptions due to shortage of cars and delays in transportation. All of these factors and the general increase in the cost of all items entering into the problem of manufacturing cement have vexed the cement makers and have compelled them to charge more for their product, a situation which is not at all relished by them because of the fact that one of their most prominent arguments for the use of concrete is not only its economy and permanence, but its relative low cost as compared with other materials which for many purposes are rivals of concrete."

Concrete Brick

Articles have been filed for the Shope Brick Company, Pocatello, Idaho, with a capital stock of \$25,000, R. J. Cruse et al, directors. Purpose of the company is to manufacture by a patented process waterproof faced concrete brick.

Labor and Roads

With the coming of spring, contractors are getting their equipment together and making plans to begin early work upon their road construction contracts. Many have their machinery and tools already on the ground left from uncompleted contracts of last year, and others are purchasing new equipment either for new work or to change the method of operation for faster and more economical means.

The labor situation has been growing steadily worse on account of the large production of manufactured articles necessitated and demanded of the United States to take the place of the curtailment of similar European industries. Raw products are also demanded in larger quantities to supply the added material for manufacture. These conditions have created a heavier demand on all labor, which, coupled with the practical cessation of immigration and the recalling of many foreigners to their home countries to serve in the army, have combined to seriously deplete the supply of what is ordinarily called unskilled labor.

The economic law of supply and demand has immediately asserted its power in raising wages. This is also aided by the constantly increasing cost of living. From the viewpoint of the road contractor, whose success depends upon the supply and cost of labor more than any other factors, the present conditions are most deplorable. Where it formerly was possible to have an ample supply at all times and to refuse applicants for jobs every day, the contractor now has to search all sources for men, arrange special convenience, and make extraordinary concessions with regard to pay days to attract labor and to hold men on the job after securing them. As an example of what the contractor must face during the coming season, laborers formerly plentiful and satisfied with \$1.75 per day, now are restless and scarce at \$2.50 per day, and moreover are much less efficient for work requiring a slight amount of skill.

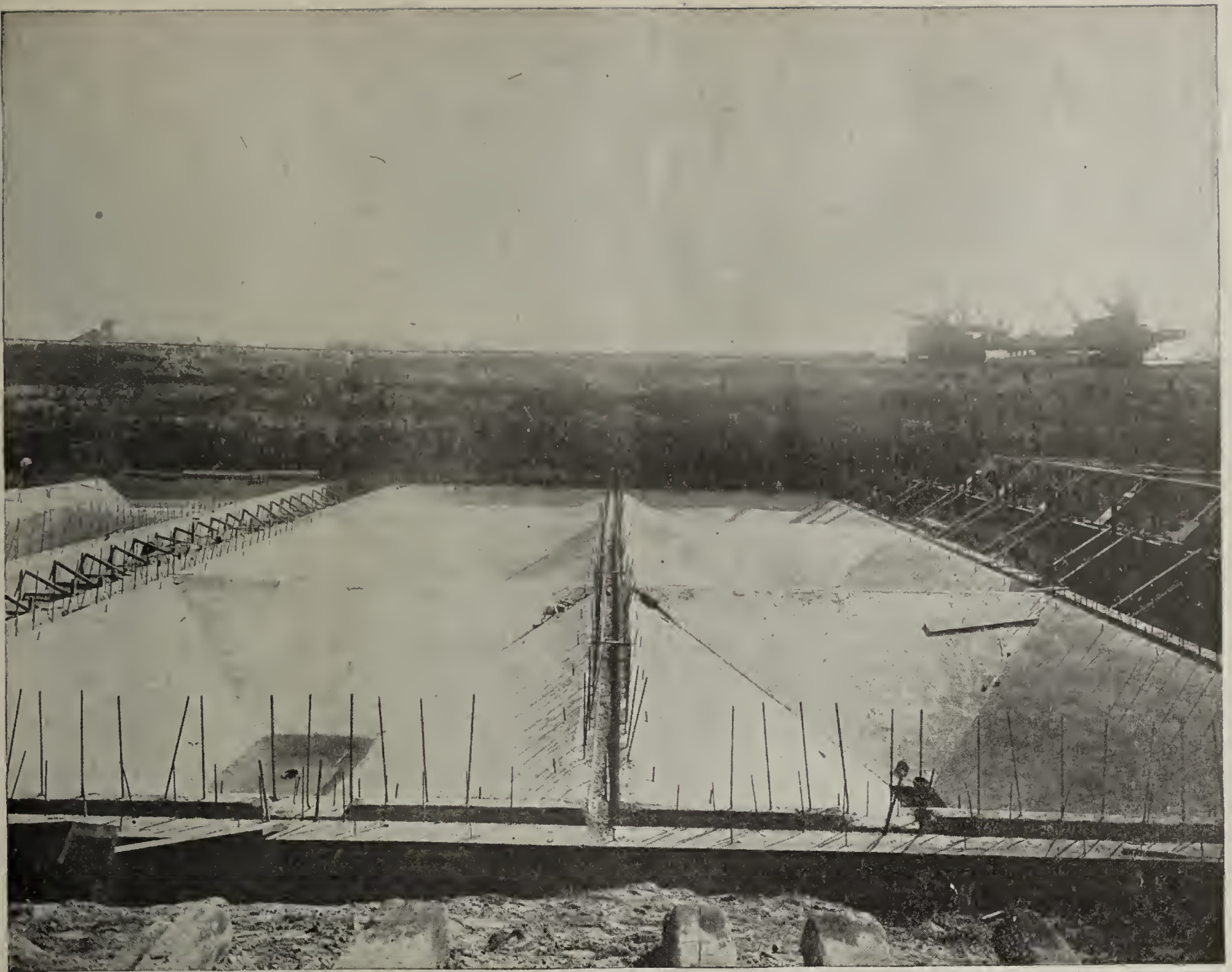
The gravity of the situation has led to the adoption of as much machinery and labor-saving devices as possible, not alone for the saving effected in cost, but in order to be sure that the work will be done on contract time, which might not be the case if he were to remain absolutely dependent upon scarce and restless labor.

A contractor on a piece of road in Pennsylvania last year completed his section of the road on time at less cost by the adoption of labor savers, while brother contractors on different sections of the same road who depended upon hand labor found the cost very high, were hindered by the labor shortage, and unable to finish their contracts within the time limit.

This contractor used dynamite to blast outfall drainage ditches, a steam shovel in all cuts, using low strength dynamite to loosen the ground and speed up the action of the shovel, and automatic dump wagons to haul out the earth. The other contractors dug many of the ditches by hand and used pick, plow and hard shovels in digging and loading the earth in cuts.

In many instances the size of the contract or depth of cuts will not permit of the employment of a steam shovel, but in these cases the use of plows and dynamite to loosen the material and of wheeled scrapers for hauling on short distance work will effect a saving.

The contractor should make a careful study of conditions that we may encounter and lay his plans accordingly. All work possible should be done by labor-saving devices. What may seem a heavy initial expenditure for equipment will very probably prove to be a wise investment before the contract is completed. It is worse than folly to use slow, costly methods.



Rochester Sewage Disposal Plant. Showing Sloping Tank Bottoms Where Rather Dry Mixture Had to Be Used.
C. Arthur Poole, Supervising Engineer.

Concrete Sewage Treatment Plant AT ROCHESTER, NEW YORK

The sewage of Rochester, N. Y., is collected from the main sewers of the city by an intercepting sewer and carried to a treatment plant in the town of Irondequoit, near Lake Ontario, the treated effluent being discharged through an outlet pipe into the lake 7,000 feet from shore, where the water is 50 feet deep.

The intercepting sewer discharges the sewage into six detritus tanks arranged side by side, the entrance to each tank being provided with a coarse rack with 2-inch openings for rough screening. A gate at the entrance of each tank makes it possible to use at any time any desired tanks. Each tank is 90 feet long and 10 feet wide and has an effective depth of 3 feet, so that about 100 cubic yards of grit can accumulate before cleaning. An excavating machine does the cleaning mechanically, drainage being provided for during cleaning by a system of underdrains. At the outlet end of each tank is a revolving screen with $\frac{1}{2}$ -inch openings, mechanically cleaned, for a careful screening of the sewage before it passes to the main influent channel for distribution to Imhoff tanks.

The plans provide for 10 Imhoff tank units, each with a capacity to handle the sewage from 40,000 people. As the population of Rochester is but 250,000 at present, only 7 of these units are constructed at this time, the others to be added as the growth of the city may demand.

Each unit is practically six Imhoff tanks, in two sets of three each, the sets being arranged side by side. The drawing of the plan of a double Imhoff tank shows the arrangement of the six tanks with the sludge channel running between the two sets of three each.

Five of the units are placed on each side of the main influent channel, which is about 395 feet long, each unit, as shown on the drawing, being 79 feet wide, measured on the line of the influent channel, the entire plant being about 435 feet long.

Each tank in a unit is 110 feet long and 35 feet wide, with a maximum depth of 40 feet. With the various influent, effluent and sludge channels the outside dimensions of a unit shown on the drawings are made up, viz: 79 feet along the main influent channel and 116.5 feet perpendicular to it.

The outside walls of the Imhoff tanks proper are 2 feet thick, designed to resist an earth pressure from backfill to top of wall on the outside and a maximum depth of 27 feet of water on the inside. There is one of the transverse walls shown in the cross section of the right-hand tank in the drawing every 12 feet 4 inches, cutting the outside wall into panels. These 18-inch transverse walls carry the troughs, etc., above and serve as buttresses against outside pressure and ties against that from the inside. In the side walls at each transverse wall are placed two 10-inch channels, 24 feet long, acting as pilasters. Six $1\frac{3}{4}$ -inch tie-rods in the transverse walls, attached to these pilasters, tie the side walls together. End walls are tied together in like manner, the tie rods running from end to end of the tanks in the triangular concrete sections located in the slots at the base of the sloping bottoms of the upper part of the tanks. Horizontal reinforcement in panels is $\frac{3}{4}$ -inch, bars closer spaced toward the bottom of the wall. The middle longitudinal wall between the two tanks is

30 inches thick, reinforced to carry water pressure with either tank full and the other empty.

It will be noted that all the tanks are rectangular in form.

The entire structure is waterproofed by the integral method which is described as follows:

Proportioning the Waterproofing Material

The usual specification for using a paste waterproofing states that a certain amount by volume shall be mixed with a certain number of parts of water. This mixture is then to be used in place of clear water for tempering the cement and aggregate.

Since the amount of water used for each yard varies from 25 gallons to 40 gallons, so also will the amount of waterproofing per cubic yard vary. For example, we will take a waterproofing that is used in the proportion of one part by volume to 36 parts by volume of water. If 1 gallon of waterproofing was mixed with 36 gallons of water there would be a total of 37 gallons of waterproofing mixture to be used the same as clear water for tempering the cement and aggregate. Assuming that the waterproofing weighs 8 pounds per gallon, then every gallon of mixture would contain $1/37$ of 8 pounds, i. e., 0.216 pounds of waterproofing. The contractor using 25 gallons of water per cubic yard will use 25 times 0.216, or 5.4 pounds of waterproofing, in every yard, while the contractor using 35 gallons of water will use 35 times 0.216, or 7.5 pounds of waterproofing, in every yard. This would mean that one man is using too little or the other too much. It demonstrates that uniform results cannot be obtained by mixing the waterproofing as specified above. It is necessary, instead, to specify that a certain number of pounds of waterproofing shall be used per cubic yard and then introduce that number of pounds regardless of variable factors.

A method has been worked out by which this may be accomplished easily and simply, which has been used very successfully on several large operations, including the Rochester sewage disposal plant, Bevis Hill reservoir at Schenectady, New York, Omaha reservoir, and others.

One of the most interesting was the Rochester sewage disposal operation illustrated and described above. There were several large concrete tanks which had sloping bottoms. A concrete of moderately dry consistency (28 gallons of water per cubic yard) had to be used on the bottoms, and the side walls were poured with a concrete of wet consistency (35 gallons of water per cubic yard). Mr. Poole, chief engineer, was very anxious that the concrete should be uniformly waterproofed and, of course, this could not be done by mixing one part of paste with 36 parts of water. Also, the contractors had bid a certain amount per yard for waterproofing and they had to be assured that they would not use a greater amount than that specified. It was decided that 6 pounds of paste per cubic yard was sufficient for this job, and it was introduced as follows:

The head was knocked out of a barrel of paste and half of it removed to an empty barrel. About five gallons of water was added to the half barrel of paste and the mixture was stirred thoroughly. The object of this stirring with a small amount of water is to prevent the formation of lumps, which are liable to occur if all the water is added at first.

When this has been thoroughly stirred to a smooth consistency, more water is gradually added while stirring until the barrel is full. This gives a thick, creamy mixture containing one part of paste and one part of water. The paste weighs 8 pounds per gallon. So every gallon of one-to-one mixture contains 4 pounds of waterproofing paste. Since 6 pounds of paste was to be used in every yard, $1\frac{1}{2}$ gallons of the one-to-one mixture was necessary. The mixers used were of $\frac{3}{4}$ yard capacity, and so in every batch there was used $\frac{3}{4}$ of $1\frac{1}{2}$ gallons, or $9/8$ gallons, of the one-to-one mix. A measure was made

which held just the correct amount for one batch, and the workman filled this and dumped it into each batch as the cement and aggregate were added. This insured that 6 pounds of paste would be introduced into every yard of concrete, regardless of the number of gallons of water used. Each night the number of yards of concrete and the number of pounds of paste used were accounted, giving a check on amount. This was a good safeguard. On the first day's run it was found that each batch was running a little over $\frac{3}{4}$ yard, and on the next day a slightly larger amount of the paste mixture was added.

When this specification was first advocated there was fear that the waterproofing would not uniformly distribute itself when added in such a concentrated form directly into the eye of the mixer. But the method has been used on any number of operations, both large and small, with perfect success. Even when the concrete is hand mixed this method gives perfect results. It stands to reason that if a concrete mixer will make a homogeneous mass of cement, sand, stone and water, that it will also uniformly distribute a waterproofing which in itself is mixable with water.

This method is very easy to use. All that it is necessary to know is the number of pounds to be used per yard and the capacity of the mixer.

This method has several advantages over other methods. A barrel of one-to-one mixture will last a half day on an ordinary operation, which means a saving because an extra laborer will not be required for mixing the waterproofing. The job can be figured to within a few pounds of the amount needed and the contractor can figure his waterproofing bid more closely. The architect or inspector can check the contractor at any time by recording the number of yards of concrete poured and the number of pounds of paste used.

The paste in the one-to-one mixture does not separate out very rapidly, but it should be stirred every time before taking out a measure full. Usually one stroke of the paddle is sufficient to keep a uniform mixture.

The plant was designed under the supervision of E. A. Fisher when city engineer and the late Emil Kuichling, consulting engineer. The construction is under the immediate charge of C. Arthur Poole, general assistant engineer for the sewage plant, to whom we are indebted for data. Myers and McWilliams, Rochester, N. Y., are the contractors.

Cement Company Pays for Accident

Mrs. Joseph Lipska was awarded compensation in the sum of \$1,785 or half pay of her husband for a period of 300 weeks, as a result of injuries which resulted in his death, while working at the Huron Portland Cement Company plant. Mr. Lipska was injured at the plant on September 29th and died in the Donald McRae hospital on October 5. The case was heard in the courthouse before an arbitration committee consisting of Ora E. Reeves, deputy commissioner of the State Industrial Accident Board, James C. Owens and Arthur Wentz. Attorney Frank T. Hinks appeared for Mrs. Lipska and Attorneys Lee Scroggie and Albert Meder for the Huron Cement Company.

Want Cement Road to Yellowstone Park

Since the enactment of the law by which the United States government will pay half the cost of construction and furnish men who understand road building to oversee highway work in the different states, a movement to build a cement highway from Cheyenne, Wyo., to the Yellowstone National Park has been started by the good roads workers of the state. The cost of such road is computed at \$14,000,000.

The Concrete Institute Convention

The annual convention of the American Concrete Institute took place in Chicago, February 8 to 10, inclusive, or simultaneous with the first days of the Chicago Cement Show, which was held February 7 to 15, inclusive. The convention was well attended and a large amount of valuable information was presented in papers and committee reports. Notes on three subjects presented which are of interest to railway maintenance men appear below.

The cement show, which was the tenth to be given in Chicago, occupied the Coliseum, and 175 firms exhibited. The show conformed with the policy and general plan followed in more recent years by the organization in charge of this exhibit by catering directly to the concrete constructor and his needs. While demonstrating a healthy development in the concrete industry, the tendency toward standardization was the prevailing note of the show, and was marked by an almost entire absence of freak ideas. This was to be noted particularly in the common exhibit of the National Association of Mixer Manufacturers. Another feature of the show which was of particular interest was the joint educational exhibit of the Portland Cement Association, designed to illustrate the possibilities of the field and give object lessons in the production of good concrete.

Concrete Piles

Charles R. Gow, consulting engineer, Boston, Mass., gave a lantern slide talk on concrete piles, plain and reinforced. He covered the subject of cast and drive piles, describing the usual form and also those intended for special purposes. This included piles designed to withstand exceptionally difficult driving conditions and those arranged to facilitate jetting. A special type was shown in which the pile is driven by means of a jacket so that the effect of the hammer is applied directly to the base of the pile and does not in any way affect the shaft.

Under methods of manufacture special emphasis was placed on the need of an unyielding foundation for casting the piles to insure that they will not be injured by settlement of the forms. The longitudinal reinforcement must be provided to withstand the stresses caused by lifting them preparatory to driving, but these stresses may be reduced materially by the use of special bridle rigs for lifting them. This was illustrated for a number of cases, including the longest concrete pile ever made, 106 feet.

Driving caps were also illustrated, showing the method of using cushions of wood blocks, coiled ropes, sawdust and pieces of hose. The cast iron caps were recommended over those made of structural steel since the latter show a tendency to loosen up at the riveted joints during driving. A method of driving sheet piles by churning was also shown; that is, working the piles up and down by utilizing the effect of their own weight without the assistance of a hammer.

In comparing the precast piles with those built in place, the former were recommended as being the safest, but with the disadvantage that it is necessary to wait thirty days after the piles are made before they can be driven, whereas most building owners are unwilling to undergo a delay of this kind after having let a contract for a structure.

The second portion of this paper covered the various types of built-in-place piles. This included the Raymond pile, consisting of a sheet metal shell, driven by a mandrel, which is filled with concrete after the mandrel has been withdrawn. These piles have been in use since 1903. The Simplex pile was also described, which consists of a stiff steel shell driven by a hammer and then withdrawn as the concrete is placed. The develop-

ments through which these various types have passed were described in connection with a discussion of the effect of subsequent driving on piles of this type already in place.

Unit Construction

John E. Conzelman, civil engineer, St. Louis, Mo., reviewed the development in the construction of the unit reinforced concrete members in an especially arranged yard or factory to be erected at the site of the structure after having been properly cured. He pointed to the particular advantage of the production of concrete, under what he termed factory conditions and cited a long list of classes of structures which had been built according to this method. This included sea walls, caissons, docks, retaining walls, tunnel linings, culverts, pipes, sewers, fence posts, poles, buildings, bridges, roundhouses, train sheds, etc. In his opinion the railway field offers a material opportunity for development along this line and such structures as engine houses, freight sheds, snow sheds, train sheds and small stations offer special opportunities for the development of unit standards. Savings of 30 to 40 per cent were estimated as possible with the adoption of this type of construction. The paper was illustrated by lantern slides illustrating examples of structures of various kinds, including train sheds of the unit type at Denver, San Francisco and Los Angeles, concrete cribbing on the Rock Island at Chicago and a roundhouse of the Santa Fe at Riverbank, Cal. Attention was also drawn to the fact that, except for the very heavy slabs developed by the railroads themselves for trestle bridges, practically all of the unit construction done so far has been developed by a very small group of firms and individuals.

Hydrated Lime

Hydrated lime was the subject of considerable discussion, and although a report on the progress of some tests to establish the influence of this material on the strength and other qualities of concrete was withheld, some interesting facts were brought out in discussion relative to the increased plasticity of concrete to be secured with the use of hydrated lime. By adding this to the concrete it may be made to flow in chutes or from buckets or cars much more readily than without this ingredient. This practice was said to do away with the common tendency to use an excess of water. One speaker stated that there was no question but that concrete of maximum density and imperviousness can be secured through proper proportioning, grading, mixing and placing without the addition of any other ingredients than the cement, aggregates and water. He called attention, however, to the fact that the requirements to secure these results were difficult to realize under field conditions and that the use of hydrated lime materially reduced the difficulties encountered.

Attention was also called to the fact that contractors have purchased hydrated lime at their own expense when not required by the specifications for the work, because of the savings to be secured in labor, lower grades for the chutes and the general ease with which the concrete could be handled.

Concrete Culvert Pipes

Phil Easterday, manufacturer of reinforced culvert pipes, Board of Trade building, Portland, reports he is very busy filling culvert orders for the Goldendale branch of the Spokane, Portland & Seattle Railway. The outlook for this season is very good. He has orders for nearly one thousand culverts to be supplied the different railroads of the Northwest.

New Reinforced Concrete Hotel at Aurora, Ill.

The new hotel at Aurora, Ill., is an interesting example of reinforced concrete for hotel construction. It is of the flat slab type with square concrete columns.

This eight-story fireproof structure on the Lincoln Highway is located on the bank of the Fox River. Forty-six piers and a wall forming the back were sunk twenty-five feet to solid rock to obtain a secure footing. Water flowed in and partly filled this excavation and some of the concrete had to be poured in about two feet of water. The concrete was deposited in place by means of a chute with the lower end at the position where the concrete was desired and the upper end above the water. Due to the location of the hotel it was decided to build a balcony extending over the river and this presents rather an unusual feature, as this cantilever extends ten feet over the river. It is forty-four feet long and carries two stories.

The building covers an area of 110 by 170 feet, is eight stories high and contains 124 guest rooms. Underneath is a basement 10 feet deep. The floors were designed for 100 pounds per square foot in public rooms and 50 pounds per square foot in the bed rooms. The first story is 13½ feet in height, the next six are each 9

around the windows and doors and for sleepers and other wood work. Only about 60,000 feet of the 4 by 4 inch stuff had to be shipped away for other jobs. The careful use of the material for forms meant considerable economy to the contractors.

A point especially worthy of mention is the fact that concrete presents distinct advantages at the present time when deliveries of steel are so much delayed. While a steel building can be erected more quickly than concrete if the materials are all on the job, nevertheless, now, on account of the difficulty of securing delivery of steel, concrete has distinct advantages in the time of erection.

The superintendent of construction stated that there had not been a single serious accident in the construction of this building and he considered concrete to have the advantage over steel in that there was less danger of accidents. Another factor to be considered in the use of concrete is the lower cost for plumbing. The laying of pipes and conduits is more easily handled in the case of reinforced concrete construction. The true alignment preserved and the splendid even surface of concrete obtained, free from pockets, is evidence of the care and skill that were exercised in the erection of this building.

The total invested was approximately \$210,000. Seven thousand barrels of Portland cement was used on this job.



Interior View of Hotel Aurora, Showing Column and Stair Construction and Flat-Slab Floors and Ceilings. Loads Are 100 Lbs. Per Sq. Foot for Public Rooms and 50 Lbs. for Bedrooms.

feet 6 inches and the eighth is a total height of 14½ feet, having a suspended ceiling with plumbing above, which leaves a clear height of 9 feet. The flat slab allowed of considerable economy in space and also in cost of erection. The only beams used were the ones at the elevator and stairs and for forming lintels over the windows. An indication of the strength of this construction is that within one week after the first floor had been poured the bracing was washed away and the slab showed no sign of failure, in spite of the fact that this occurred during a period of very cold weather when the concrete would ordinarily harden slowly.

Of particular note in the economy realized in the use of lumber owing to the elimination of beams. About 175,000 feet were secured for the job. After the lumber had been used for forms it was possible to employ practically all of the 7/8-inch and 2-inch stuff for finishing the interior

Polk System of Metal Forms Opens Chicago Branch

Polk-Genung-Polk Company, Fort Branch, Indiana, announce that they will open an office in Chicago in booth 1333 and 134 on the second floor of the Insurance Exchange Building, at 175 West Jackson boulevard. These booths are in the department of exhibits of the Building Material Exchange.

They expect to arrange a permanent exhibit there and also expect by the time the building season opens, to be using the space as a regular Chicago office. In this exhibit they will have a half sized model of the Standard Polk System machine and also smaller models of the grain storage building form.



Construction of the New Reinforced Concrete Hotel Aurora, Aurora, Ill.

Owned by Aurora Island Development Co.
 Architect—H. Ziegler Dietz, Evansville, Ind.
 Engineer—Concrete Steel Products Co., Chicago, Ill.
 Contractor—Caldwell-Marshall Co., Evansville, Ind.
 Building begun October, 1915, to be finished January, 1917.

Building 110' x 70', 8 stories, 124 rooms; basement 10' deep.
 Loads per sq. ft., 100 lbs. for public rooms; 50 lbs. for bedrooms.
 Flat slab floors.
 Story heights—1st, 13' 6"; next six stories, each 9' 6"; 8th, 9'; attic, " 6".
 Concrete chosen for economy and fireproofness.

Improved Red Cross Dynamite

Resulting from careful research work, the first Red Cross Dynamites placed on the market were improvements in low freezing qualities over the previously used high freezing dynamites. Because of this improvement, they did not require thawing until later in the fall and the necessity for thawing ceased earlier in the spring. This advantage together with increased safety in handling has made them the general favorites for various mining conditions, quarrying, agricultural and other open work.

By further research work, we have materially improved the Red Cross Dynamites, so that they give still better results than the old Red Cross, writes the Du Pont Powder Company, Wilmington, Delaware.

The present products are stronger, quicker, less liable to exudation, are as sensitive to detonation, stand storage better and withstand lower temperatures without freezing than the older Red Cross Dynamites.

The Red Cross Straight Dynamites are as strong as the regular straight dynamites, and are so close to them in quickness that the difference is hardly discernible. They can be used very successfully in all kinds of work where straight dynamites have been or are being used where a quick rending explosive should be used. They should not be used in wet ditch blasting by the propagation method.

Red Cross Dynamites are as strong as the Red Cross Straight Dynamites, but not as quick. They are, therefore, well adapted to work where a slower and more heaving explosive is desired. They are also efficient in ore mining, as the fumes are not disagreeable.

Because of the many good qualities of Red Cross Dynamites: efficiency, convenience, increased safety and economy, every user of explosives should give them a careful trial in comparison with other explosives, he may be using.

How to Make Damp Basements Dry or Leaky Cisterns Water-tight

When the necessary precaution has not been taken during construction to damp-proof a basement or to make a cistern water-tight, permanent waterproofing results can be secured by following these simple directions:

If already plastered and it has not adhered to wall in places, which can be determined by striking with a hammer and noting a "dead" sound, remove old plaster. Roughen the surface to be treated by chipping with a cold chisel or similar instrument and rake brick joints to a depth of $\frac{3}{4}$ of an inch to obtain a bond for the new plaster coat, and clean with a heavy wire or stiff broom to remove all dirt and dust. Clean walls and floor thoroughly by scrubbing with a good stiff brush and water, or preferably wash the surface with a solution of 1 part hydrochloric acid to 10 parts water, allowing this to remain about 10 minutes, and then thoroughly rinse off the surface with clear water (with a hose under good pressure) to remove the chemical and loose particles resulting from the action of the acid.

To the cleaned saturated surface (or after wetting the surface thoroughly) apply a coating of neat cement and water, to which 2% of Medusa waterproofing has been added, mixing to the consistency of thick cream. This grout can be applied with an ordinary brush, but should not be used very far in advance of the plastering, so that the grout paint will not have an opportunity to harden before the plaster is applied.

The plaster coat should consist of 1 part Portland cement, $1\frac{1}{2}$ parts clean sharp sand, and 2 pounds Medusa Waterproofing powder or paste to 100 pounds cement. The waterproofing powder should be thoroughly mixed dry with the dry cement before the addition of sand and water, or Medusa Waterproofing paste should be mixed with the water used. Better still, use Medusa Waterproofed Portland Cement, which is the regular Medusa Gray Portland with Medusa Waterproofing ground in the process of manufacture, manufactured by the Sandusky Cement Company, Dept. T-6, Cleveland, Ohio.

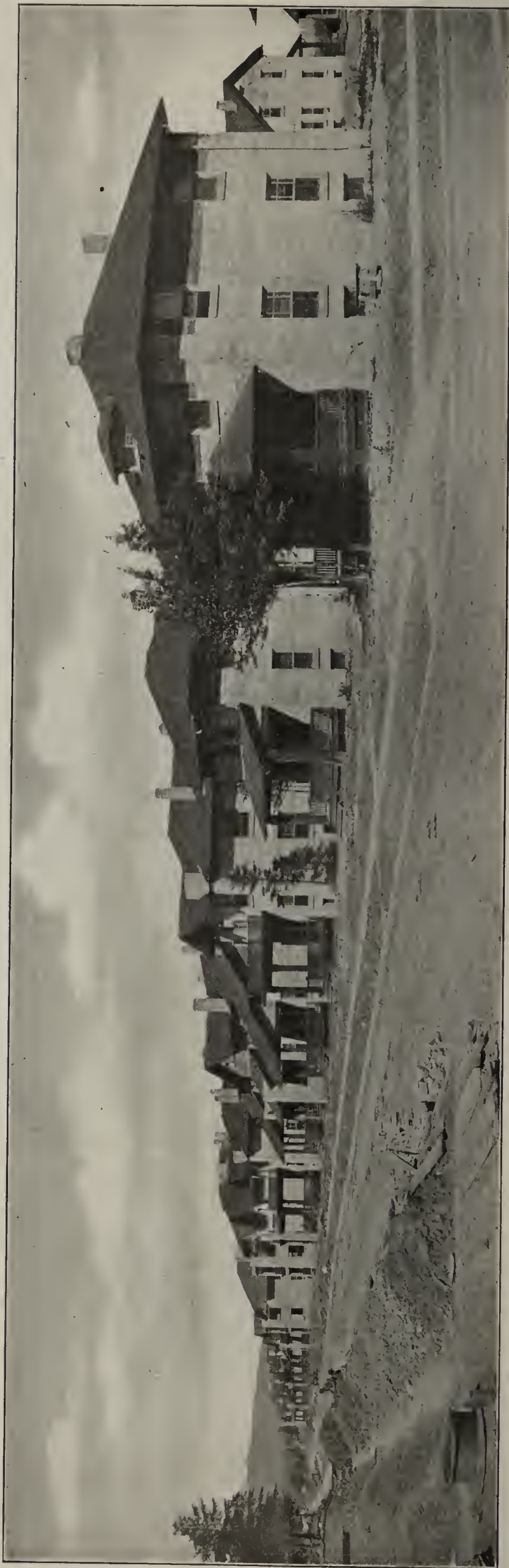
Apply the plastering mortar $\frac{1}{2}$ inch to $\frac{3}{4}$ inch thick on the walls and about 2 inches thick over the floor. Special care should be taken to bond the wall and floor coatings, so as to make the waterproofed work continuous over the entire surface.

No more mortar should be mixed than can be used within thirty minutes. It can be applied with a steel trowel, and should be thoroughly worked at once with a wood float to make it as dense as possible. Final finishing may be done with a steel trowel, trowelling for not more than one minute and then leaving undisturbed. Excessive trowelling will result in checking.

If there is a continual seepage through the walls, pipes inserted to concentrate the flow of water and relieve the pressure while the plaster coat is being applied. Caulk around pipes with oakum. Drainage pipes should remain open until the waterproofed coat has thoroughly set and is capable of resisting the pressure by its own adhesive strength, after which remove pipes and plug holes with cork or wood and cover with waterproofed cement plaster.

If the water pressure is exceedingly great, it will be necessary to sink sumps on the exterior of the walls to a depth below the basement floor level, and keep pumps going continually until the plaster has thoroughly set.

The finished surface must be protected from too rapid drying out by keeping moist for at least a week to allow it to thoroughly harden and to prevent hair-cracks.



This row of residences (a portion of the Model City of Morgan Park, Minn.) constructed by the Minnesota Steel Company, a subsidiary of the United States Steel Corporation, is all made of the unfaced Synstone 8-inch single wall construction. Important improvements have been made in machinery and facing since these were constructed.



Chicago, Burlington and Quincy Railroad Station, Moosehart, Illinois. Granite-Faced Synstone System.

"Synstone" Construction

For more than four years John A. Ferguson has been perfecting and testing a machine and its product. Some would call this a cement block machine, yet the building units it produces have so little in common with the ordinary run of cement blocks that it seems only fair to give it an entirely new name, and not to think of it in terms of the ordinary cement block business.

Mr. Ferguson calls it the Synstone machine, and the building units it produces are called Synstone; in other words, synthetic stone, or artificial stone put together by man instead of by nature.

The form in which Synstone is produced has permitted Mr. Ferguson to work out several revolutionary changes in building construction. He builds a moisture-proof, fireproof, masonry wall that costs no more than common frame construction.

Several years ago, Mr. Thomas A. Edison predicted that science would some day give every man a concrete house at no greater cost than a frame house. The world gave eager ear to his words, and there are today thousands of home builders awaiting the realization of his prophecy. Those who have examined and tested Synstone, and have studied the possibilities of the Synstone System of construction, are confident that it means Edison's dream come true, that is, a concrete home at no greater cost than an ordinary frame house—a home, the exterior of which may be faced with beautiful granite, white marble, sandstone or other desired finish.



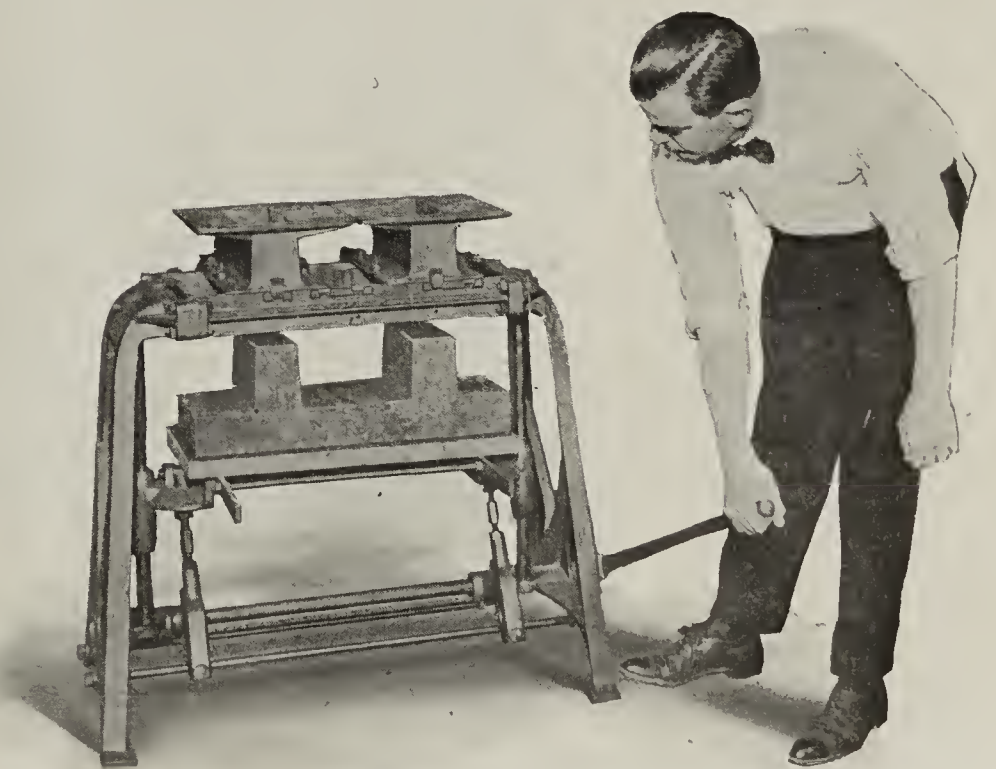
Interior Construction, Before Furring and Plastering, Showing Interior of Synstone Single 9-Inch Wall Construction.

The Synstone unit is made of wet concrete, carrying a considerably quantity of large size aggregate. Everyone knows that a wet mixture means a solid, strong, impervious stone. The problem has been that a wet mixture has always meant slow handling, or in other words, costly production. The Synstone method solves this speed problem. The shape of the block enables it to stand up when immediately removed from the machine.

The blocks are made with two prominent lugs, and this is the second great advantage of this building unit, since with this style block a very economical, though strong and beautiful wall can be erected, as illustrated in the photograph and drawing herewith.

Notice how the metal nailing plug is placed in the cement mortar between the lugs. To this are nailed the furring strips. To these furring strips any type of lath construction may be nailed, either wood, metal or plaster-board. It insures a warm, damp-proof wall.

Joist ends are supported by a strip of $\frac{3}{8}$ -inch flat steel laid in the mortar joint toward the back of the blocks. These steel straps are bolted together at the



The Synstone Machine.

The Synstone System Machine uses wet mixture. Operates by hand—requires no power pressure.

In the above position the machine has discharged the 3-inch-thick wall block. The lug boxes have been dropped forward in place.

In releasing the block from the machine, the operating lever travels a curved path, thereby lowering the pallet on which is the finished Synstone block.

The block is then removed on the pallet. A clean pallet is then placed in position, the operating lever thrown back, and the machine is ready for another block.

corners so that they are perfectly secure. Where extra strength is wanted, as for instance, in earthquake regions, such straps may be laid in every few courses to reinforce the wall.

Simple adjustments of the Synstone machine permit blocks of many different sizes and styles to be produced. The average cost of manufacture, including materials and labor, is a little more than 5 cents per square foot of wall surface. The blocks can be laid in the wall at an average cost of about 6 cents per square foot, making a total cost to make and lay Synstone (without profit, but including royalty), about 12 cents per square foot of wall. A handsome profit can be added, and the price still be low enough to land almost any contract.

This is a big, interesting subject, and we wish it were possible to give all of the details of it here and to show more of the very unusual photographs and drawings which are needed to do the proposition justice. However, our lack of space prevents this, and we accordingly refer our readers to the Ferguson Synstone Company, 809 Seventeenth street, Denver, Colo. They will send free on request their illustrated handbook and full particulars concerning their exclusive license proposition. They are leasing this system to one responsible building contractor or concrete man in each locality. A nation-wide advertising campaign is to be launched that will make Synstone a household word in America as commonly known as the words "brick," "lumber" or "stone." It is expected that this advertising will create for Synstone a good-will and prestige, and consumer demand of inestimable value. Local representatives of the Synstone System will naturally reap the benefit of this.

Investigate this proposition today.

955,967, or more than two-thirds the total of money expended so far on the construction of the Panama canal—for road improvements throughout the country. Mr. Davis' contention is that good roads, roads that run for thousands of miles through state after state, are properly not the responsibility of the state, but of the nation. He would have the federal government build a system of national roads joining the west with the east, the north and the south, connecting every part of the country, as is the case with the national highways of Europe, and, as history shows, such as was the essential equipment of every first class power of the past.

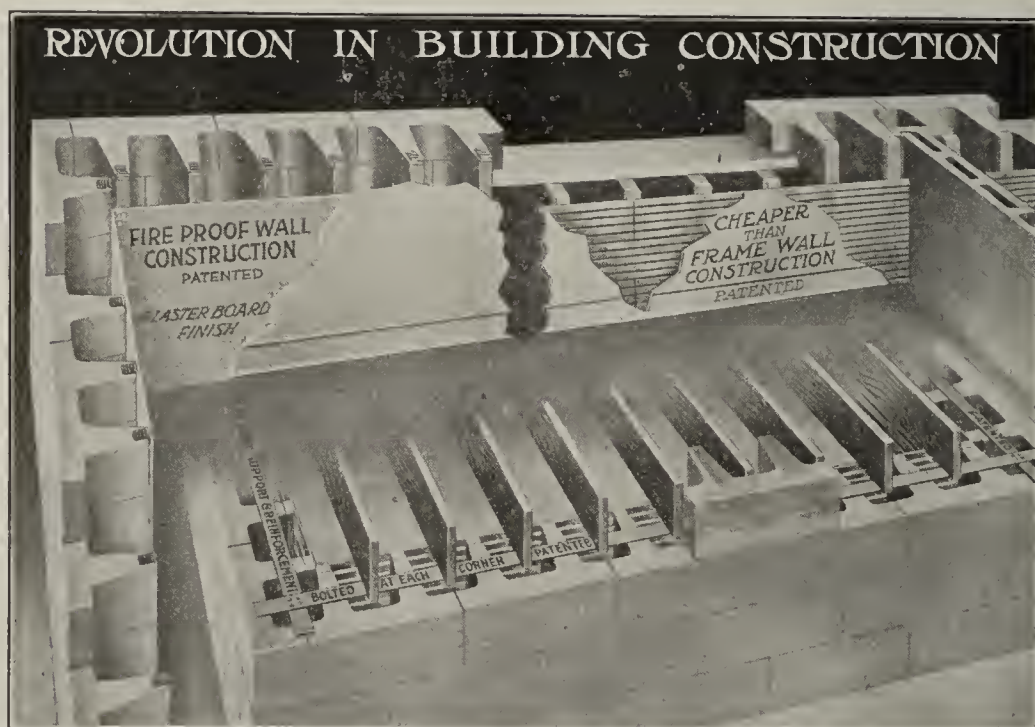
How would such an enormous construction be paid for and kept up?

"Suppose," asks this eminent engineer, "the government built 100,000 miles of properly planned roads, and at the same time purchased, say, 300 feet of land on either side? This land would so continually increase in value and in demand for leasing on long rental that the cost of the road and the land purchase would soon be paid. A rental rate of \$6.66 per acre would pay the interest on the cost of construction. But such would rent at vastly higher rates in cities and towns, high enough to give the nation an income equal to its total annual expenditures," from these national highways alone!

Building Roads with Motor Trucks

Louis Martine, road contractor, La Porte, Ind., has set a new standard for road construction in recently completing \$90,000 worth of highway work with two motor trucks.

In addition to pulling graders with his trucks, Mr.



The above illustration shows Synstone Wall Construction. Either metal or wood lath or plaster-board is applied to furring strips, secured to the nailing plugs between the lugs of the blocks. This leaves a ventilated air space—a valuable feature in Synstone Wall Construction. Air can circulate vertically and horizontally. Insures absolute sanitation, dry walls and thorough insulation. At the extreme right of the illustration the Synstone Partition Construction is shown. No lathing is necessary here. The plaster is applied directly to the partition.

Road Building Nation's Task

Highways Head Tells How a Great System Can Be Built.

Thanks to the pushful, pervasive motor car, American road building has "got a move on" at last. There is everywhere the cry for roads. The drawback has been that, as yet, there has been no co-ordination of these multitudinous enterprises. The president of the National Highways Association, Charles Henry Davis, in a recent paper stated that we spent last year \$249,-

Martine used them for hauling the crushed stone. The stone was taken from the freight cars by a Byers auto crane, hauled one mile to the new road bed, dumped, spread and rolled at a cost of 13½ cents a yard. All of this work was done with two motor trucks and two trailers.

This equipment replaced 36 teams for the hauling work and in addition took care of the dumping, spreading and rolling. Instead of closing the road for six or seven weeks, as would have been necessary with the old style equipment, it was kept open continuously.

New Mill of the Acme Cement Corporation

What is considered the most modern wet process mill in the east was recently put in operation by the Acme Cement Corporation of Catskill, N. Y. It is equipped with sufficient machinery to manufacture 2,500 barrels of high-grade Portland cement per day, with provisions for doubling the capacity as soon as conditions will permit.

The corporation owns about 750 acres of stone and clay land adjoining the mill, with sufficient material to operate the plant at full capacity for many years.

The general offices of the corporation are located at Catskill, New York, and the sales office is located at 8 West Fortieth street, New York City.

The officers of the corporation are: President, Wm. F. Beyer, Lancaster, Pa.; first vice-president, James Shand, Lancaster, Pa.; second vice-president, John J. Matheson, New York, N. Y.; treasurer, George H. Hedge, New Bedford, Mass.; secretary, W. W. Heidelberg, Catskill, N. Y.; superintendent, A. P. Sandt, Catskill, N. Y.; chemist, R. W. Hunt & Co., 90 West street, New York, with J. F. Davis in charge.

All the buildings are constructed of steel and concrete, of substantial construction, with sufficient room

There is a large clay storage building equipped with a wheel drag conveyor for handling the clay into and out of storage to the mixing department.

Crushing and Mixing Plant

This department is equipped with a No. 10 Allis-Chalmers gyratory crusher, which breaks the rock down to about 4-inch cubes. The stone from the crusher is fed direct into a No. 6 Jumbo Williams mill, which reduces the stone to quarter-inch and finer. From the Williams mill, the stone is elevated to a set of mixing tanks, from which it is weighed into two American Clay Machinery Company's 10-foot wet pans. The clay is also added with the water in these pans, from which it is elevated to a 7x16-foot Worthington Pump and Machinery Corporation preliminary tube mill, from which it passes to storage or direct to two 7x20-foot Allis-Chalmers Com-Peb tube mills for finishing the slurry. Sufficient storage for the slurry is provided between the finishing tube mills and the kilns to operate the plant for 48 hours.

Kiln Plant

The kiln building contains four 8x180-foot Vulcan kilns, and four 6x60-foot coolers, with the necessary



New Mill of the Acme Cement Corporation.

to double the capacity, and are equipped with the following machinery at the present time:

Power Plant

This department is equipped with four vertical water-tube boilers designed to carry 175 pounds pressure with 100° superheat. These are provided with automatic stokers, overhead coal bunkers, also ash tunnels underneath, making it unnecessary to handle any coal or ashes on the firing floor, all of which is handled by machinery.

The engine room is provided with two 1,560 K. W., 440 volt, 60 cycle, 3 phase, turbo generators, one 50 K. W. and one 100 K. W. exciters, direct connected steam engines. The generators are each provided with Westinghouse LeBlanc low down barometric condensers, water being supplied from the river by three triplex single-acting motor-driven plunger pumps.

The switchboard was constructed by the Westinghouse Electric and Manufacturing Company.

Quarry and Clay Pit

The quarry is located about one-quarter mile from the mill, west of the West Shore railway, in what is known as the Helderberg ledge of limestone. At present, until sufficient room is made, the quarry is being operated by hand labor for loading, but eventually will be provided with a steam shovel. All the drilling is being done at the present time with jack hammer and hummer drills, operated by air. The stone is transported from the quarry to the mill over a standard-gauge railroad equipped with two Plymouth gasoline locomotives, also thirty 6-yard, all-steel, special skip cars.

The clay pit adjoining the mill is equipped with a steam shovel and twenty 1-yard rocker dump cars.

slurry and coal feeding devices, scales, etc. Each kiln produces an average of 30 barrels of clinker per hour from the slurry, which contains about 33 per cent of water.

Coal Pulverizing Plant

This building is equipped with two 48-inch by 30-foot Matcham dryers and three 42-inch Fuller-Lehigh mills with the necessary elevators, conveyors, etc. There is also a steel and concrete coal storage building with a capacity of 3,000 tons, equipped with a Link-Belt Company's Peck carrier for handling the coal from the cars to the storage and from the storage to the dryers.

Finishing Mill and Clinker Storage

In this department, they have four Maxecon Kent mills for preliminary grinding and two 7x16-foot Allis-Chalmers tube mills for finishing the cement, with large storage bins for both clinker and preliminary ground material. The clinker storage building is constructed of steel and concrete and has a capacity of 70,000 barrels of clinker. It is provided with a Link Belt Company's Peck carrier, so arranged that the fresh clinker can be put into storage while the aged clinker is being taken out to be pulverized.

The stockhouse is also constructed of steel and concrete with a capacity of about 90,000 barrels of finished cement, all live storage, in bins containing about 3,500 barrels each, with conveyors overhead for filling, and tunnels and conveyors below for emptying the bins. The packing room is provided with three automatic weighing and sacking machines. These machines are fed by a screw conveyor, each automatically weighing and sacking five 95-pound bags per minute, with an accuracy of

$\frac{1}{2}$ pound per sack. The scales are absolutely dust-proof. This is made possible by having the cement chambers of the scales enclosed in air-tight, sealed castings. All operating levers are on the outside of these castings, so that dust will not collect on them and interfere with the regular motion of the scales. The use of the scales has saved the wages of at least one man per machine, and makes the packing room practically dustless, thus greatly enhancing the efficiency of the men employed there. They are placed close to the track to eliminate long trucking to the cars, and so that the sacks can be dropped directly onto the loaders for the tramway, for loading into boats without any trucking.

For the purpose of loading boats there is a dock erected on the inner channel of the Hudson river about half a mile from the shore, or 3,000 feet from the packing room. The sacks are transported from the packing room to the dock by a tramway. This tramway is so constructed that very little handling of the sacks is required. They are dropped directly onto the loader from the machine and automatically dump themselves at the dock end, from where they roll or slide down chutes directly into the boats at the point where they are to be stored.

This tramway has a capacity of about 300 barrels per hour, so that any of the large size boats for all points that can be reached by water in the East can be loaded in ten hours.

New Cement Mill for South America

M. H. Hammond, general superintendent of the Knickerbocker Portland Cement Co., became general manager of the International Portland Cement Co. February 1. On that date he left for Buenos Aires to oversee the construction of the new company's plant and to see that operations are successfully started. In connection with this plant, Sheldon Bassett, president of the International Portland Cement Co., 1 Madison avenue, New York, N. Y., says:

"Preliminary work has commenced on the company's plant in Argentine and shipments of materials are already under way. All buildings and machinery have been contracted for and advantageous shipping arrangements made to facilitate delivery. Because consumption of Portland cement in the Argentine is much greater than will be the output of the first unit of the plant now building, the product should be readily disposed of when the plant is placed in operation. The grade of the raw materials from which the company's cement will be manufactured assures a product of the highest quality, and no trouble should be encountered in competing with the foreign brands which are now being used in the Argentine."



A Cement Tile Plant in Michigan.

The sack room adjoining the stockhouse is 36x100 feet, with main floor and basement for storage of sacks, and provided with two large mechanical sack cleaners.

There is a steel and concrete shop and storeroom 80x130 feet, fully equipped with the necessary tools to do all their own repair work, and with sufficient room to keep ample stock of repair parts and supplies.

There is also a comfortable office building and a separate building for the laboratory 16x60 feet, which is the most modernly equipped in the east.

All the machinery in the mill is driven as far as possible with individual 440 volt, 60 cycle, 3 phase motors. In most cases, a single belt drive is used, and in case of the large tube mills, gears are used.

The elevating and conveying machinery was furnished by the Link Belt Company and the Jeffery Manufacturing Company.

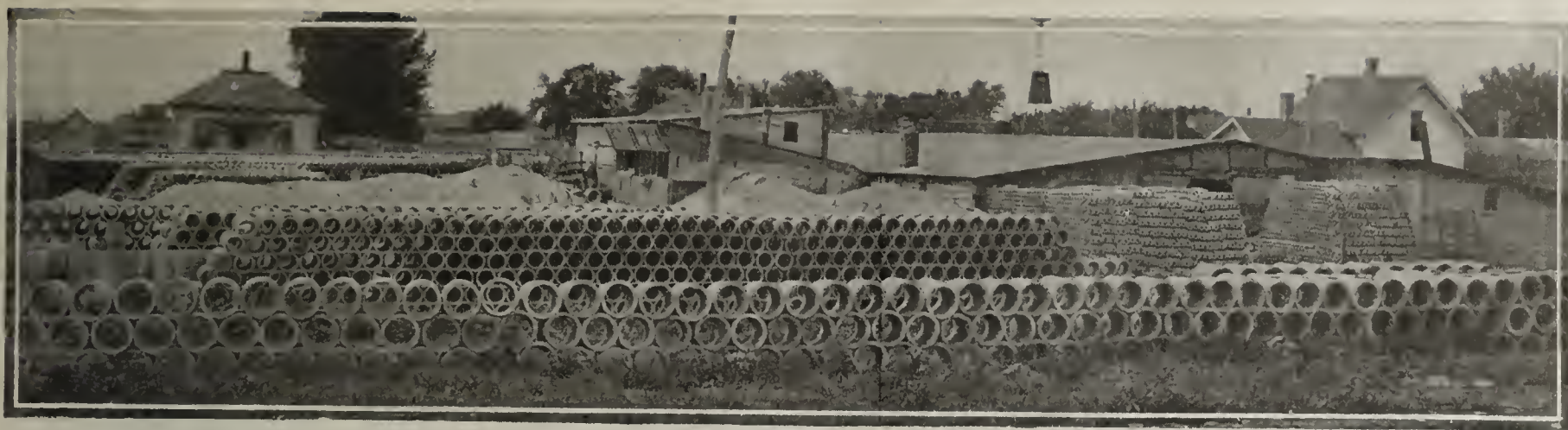
The mill was designed and constructed by C. J. Reilly, consulting cement engineer, with offices at 817 Engineers' building, Cleveland, Ohio.

Traylor Company Opens New Branch Offices

The Traylor Engineering & Manufacturing Company, manufacturers of crushing rolls, gyratory and jaw crushers and cement making machinery, Allentown, Pa., announces the opening of branch offices by Mr. John A. Traylor, western manager of the Traylor Engineering & Mfg. Co. and the Cement Gun Company, with headquarters at Salt Lake City, Utah.

These offices will be located at Spokane, Wash., for the northwest district, in charge of Mr. C. H. Abeling, sales engineer, and at El Paso, Tex., for the southwest district, in charge of Mr. Robert M. Peabody, sales engineer.

"It is interesting to note that the opening of these two additional offices by us," writes the Traylor Company, "is not so much for the purpose of more thoroughly covering the western territory, but in order to take care of our ever-increasing business."



Cement Tile Plant in Iowa.

Cement Tile

Its Costs and Profits, and Possibility as a Business

By W. E. DUNN*

Opportunity is offered in thousands of towns throughout the country, in a permanent, substantial and profitable business for someone in the manufacture of cement drain tile. Every town where the farmers now buy tile, or will eventually, presents the opportunity.

The farmer today realizes the benefits derived from proper drainage. He knows that drainage is not an expense but the greatest and most profitable investment he can make in his land. He knows that drained land can be plowed, cultivated and planted earlier, it protects him in a wet season and makes a dry season more productive. Undoubtedly it gives an increased vitality to his crops.

Thousands of acres of fine land are being reclaimed yearly from swamps and otherwise useless soil, and thousands of acres of other land, partly productive, are being made more so by proper drainage.

Cement Tile Is the Logical Drainage Medium

For many years clay tile displaced the old wooden pipe and open ditch for farm drainage, but in comparatively recent years, cement tile, true of shape, of greater durability, indisputably has been, and is, displacing the clay tile.

One of the reasons for this progress is the development of cement drain tile machines to the degree of efficiency necessary to produce a high quality of tile at a cost to enable competition with clay tile. The Dunn Machine has undoubtedly established this fact and is proving it in hundreds of plants throughout this and other countries today.

In sections where cement tile have been made they have invariably eliminated clay tile competition. They have done this not on the price, but strictly on their superior merits—their quality. The farmers prefer them because they can be laid easier, shipped and handled without breakage, and better fill the requirements for permanent and proper drainage.

The progress of a small section of less than 100 square miles in one of the Central States illustrates this point. In this small area a number of cement tile plants are operating with a production of over two million tile per year. When you consider that this demand has been created in the past few years, it demonstrates beyond question how the farmer realizes that in cement tile he has a practical, and satisfactory medium for the drainage of his land to increase its value and returns.

Among our customers we count a number of clay tile manufacturers who have installed the Dunn machines in order to supply the demand for a better tile, and they have been able to produce the cement tile for less money.

The majority of our customers are operating where clay tile plants are located, and today are selling their cement tile at a higher price and getting the largest share of the business.



A Cement Tile Plant in Sac City, Iowa.

Amounts of Material Required

Size of Cement for Tile	1000 Tile	Sand for 1000 Tile	1 Bbl. Cement Makes	1 Yard Sand Makes
4 inch	3 1/4 Bbl.	2 Yd.	308 Tile	500 Tile
5 "	4 1/2 "	2 1/2 "	222 "	400 "
6 "	6 "	3 3/4 "	166 "	266 "
7 "	7 1/2 "	4 1/2 "	133 "	222 "
8 "	9 "	5 1/2 "	111 "	182 "
10 "	12 1/2 "	7 "	80 "	143 "
12 "	17 1/2 "	10 1/2 "	57 "	95 "

The cost of materials for 1,000 tile of any size can be readily ascertained by applying local prices of sand and cement to the figures given above.

Manufacturing costs are governed by local material and labor prices. We can take only average prices as follows:

Cement per bbl. \$1.60. Sand per yd. \$1. Labor per day \$2.

The above as a basis give the following cost:

* President W. E. Dunn Mfg. Co., Holland, Mich.

Average Cost of Manufacturing 1,000 Tile

Size of Tile	Cost of Cement	Cost of Sand	Cost of Labor Power, Etc.	Total Cost
4 inch	\$ 5.20	\$2.00	\$3.50	\$10.70
5 "	7.20	2.50	3.50	13.20
6 "	9.60	3.75	3.50	16.85
7 "	12.00	4.50	4.75	21.25
8 "	14.40	5.50	4.75	24.65
10 "	20.00	7.00	6.00	33.00
12 "	28.00	10.50	7.00	45.50

The item "Labor, Power, etc.," includes overhead charges, which are figured:

Six per cent interest on a total investment of \$1,000—\$60 per year.

Fifteen per cent depreciation charge on \$500 worth of equipment—\$75 per year.

Power costs \$13.75 per month—\$165 per year.

This gives a total overhead of \$300 per year or \$25 per month. This is easily sufficient considering this charge is made against the business for the year regardless of time not operating.

Average Profits.

To get the average profit we must determine the average selling price. Investigations of selling prices of tile show them varying over a considerable range. As the prices are high or low the costs of materials are in proportion. We can strike an average, however, and give below a table with selling prices which will apply in many parts of the country.

Size of Tile	Selling Price	Profit on 1,000 Tile	Profit per Day	Profit per Month, 26 Days
4 inch	\$18.00	\$ 7.30	\$14.60	\$379.60
5 "	24.00	10.80	21.60	561.60
6 "	32.00	15.15	30.30	787.80
7 "	42.00	20.75	31.12	809.12
8 "	50.00	25.35	38.02	988.52
10 "	75.00	42.00	42.00	1092.00
12 "	100.00	54.50	54.50	1417.00

The profits above are based on a daily production of 2,000 tile for 4, 5 and 6 inch; 1,500 for 7 and 8 inch, and 1,000 for 10 and 12 inch.

Cost and Selling Price in Rods

In some sections of the country tile are figured by the rod in which case refer to the following:

Size of Tile	Cost per Rod	Selling Price per Rod	Profit per Rod	Capacity in Rods per Day
4 inch	\$0.18	\$0.30	\$0.12	333
5 "	.22	.40	.18	333
6 "	.28	.53	.25	333
7 "	.35	.70	.35	250
8 "	.41	.83	.42	250
10 "	.55	1.25	.70	166
12 "	.76	1.66	.80	166

A 47% profit on sales is an average, but profits vary according to the size of tile. Taking 6-inch tile as a basis, we get a manufacturing cost of \$16.85, and a selling price of \$32 per thousand feet—leaving a profit of \$15.15, or 47 per cent.

For every thousand dollars worth of tile sold this shows a profit of \$470. A minimum of five thousand dollars worth of tile per year are sold in many localities, in which cases the profits are \$2,350.

There are few businesses today that will produce this profit on such a small investment. Bear in mind that this is based on a product of such durability as to eliminate depreciation and loss in stock.

Cement Drain Tile made of the standard quality, produced on the Dunn machine have come to stay. The quantity of these used has increased rapidly from year to year.

In one small town a plant is operating with 4 Dunn machines, having a production of 8,000 tile per day. This is not uncommon and indicates what can be done in many localities throughout the country.

The questions to be considered are:

Does the surrounding land require drainage?

Are the farmers now using tile?

Is good sand and cement available at reasonable prices?

If the answer is "yes" there is undoubtedly an opportunity for a good business. If the answer is "no" the opportunity does not exist.

Eighty per cent of our customers, sending us reports from many localities, show a production of over 100,000 tile last year. Based on figures above this shows a profit of over \$1,500 a year each. And we know that many of them did not invest over \$1,000 in the starting—some of them considerably less.

McAdam Cement Products Works Ready for Business

The McAdam Cement Products plant, formerly conducted by Harney Bros., on East Fifth street, is now in operation and is turning out a nice supply of cement brick, cement tile and cement blocks. Mr. McAdam, since buying the plant, has installed several new machines and is now prepared to turn out work that has never been done in this city.

The cement tile is a production which has never been known here heretofore. The machine installed by Mr. McAdam is the first ever brought to Aledo. It was made in Holland, Mich., by the W. E. Dunn Mfg. Co., and turns out a perfect tile, everyone being uniform in size, and they can be produced just as cheaply as clay tile. In addition to the uniformness of the cement tile, another superiority over the clay tile is the fact that the longer cement tile are in the ground the harder and more durable they become.

This plant has a force of several men at work now and if you have never visited a cement products factory where tile is made it will pay you to call and see this one.

Mr. McAdam will also carry a stock of clay tile and brick, sand, cement, etc., for sale in addition to the cement goods produced in the plant.—[Aledo, Ill., Tribune.]

Contract for Cement Tile Amounting to \$97,298

Linnan & Clancey Co. of Fonda, Iowa, have been awarded the contract for the construction of the Dickinson-Osceola (Iowa) counties drainage district at \$97,052.10, and the Spencer Cement Products Co., Spencer, Iowa, received the contract for tile amounting to \$97,298.80.

Reinforced Concrete Pipe

Reinforced concrete pipe has been used at Vincennes, Ind., for all storm-water sewers of 30-in. diameter and over, the maximum diameter being 66 inches. No mechanical bond other than cement grout was used at the joints. The concrete for the pipe was a 1:5 mix of Portland cement with sand and gravel. The reinforcement consisted of wire netting of triangular mesh. This pipe proved very strong, one 66-in. section being tested to 34,000 pounds for 24 hours without destroying it. It was made near the work of Howard Schurmann, of Indianapolis, Ind., under the direction of H. T. Watts, city engineer.



A 5-Ton Pierce-Arrow Truck Delivering Gravel on New Construction Work.

Hauling Gravel and Stone by Motor Trucks

Machines Save 50 per cent for California Dealer

BY FRANK G. COXHEAD

General Manager, Rhodes-Jamieson Company, Oakland, Calif.

We recently consolidated with the Pacific Fuel & Building Material Company, which makes us the largest operators in the handling of building materials and fuel in Alameda County.

At present we are operating four 5-ton Pierce-Arrow motor trucks. These are all equipped with steel bodies and hydraulic hoists. The bulk of our business is in sand, gravel and rock. These commodities are handled entirely in bulk, and in this department of our business the worth of a motor truck is unquestioned. Coal is handled in sacks.

First Truck Experience

We hesitated a long time before buying our first machine. As viewed strictly from the standpoint of dollars and cents, we did not feel that the motor truck in the delivery of coal in sacks—owing to slow loading and unloading—would effect for us a saving over teams sufficient to justify the investment. However, we purchased our first motor. It was the first motor truck put to the use of hauling coal in Alameda County. Most of the time it was in the repair shop, fattening the purse of the repair man. Consequently, we paid dearly for our first experience with the motor truck. However, I will pass over the other details of our early experience, as they are indeed painful and have no bearing on the operation of the present machines which we operate most successfully.

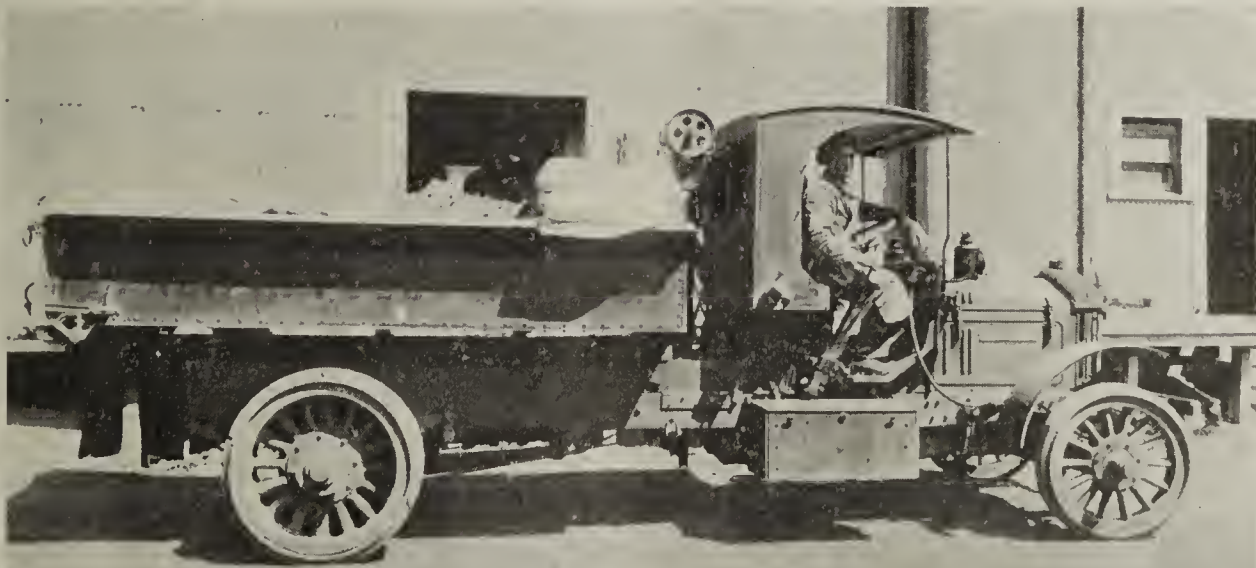
Needless to say, because of our first experience it was some

time before we could make up our minds to make another venture. In the meantime, we hired many machines and experimented carefully with different makes under all sorts of conditions. Finally, we determined upon a motor truck which, in our hired service, met every demand made upon it and, in so far as we could determine, was being operated at a very low maintenance cost and gave no mechanical trouble.

In so far as an actual saving in cost per ton delivered is concerned, we are not able to say that the motor truck has effected for us a saving in the delivery of our coal. At the same time, I am able to emphasize the fact that the motor truck has been a profitable and valuable asset to our coal business. It relieves our teams of the long hauls, which average from 5 to 6 miles in four different directions, with the result that our horses are not overworked and are always in good shape to take care of some of our short-haul business.

The advantages of the motor truck in our coal business are those that do not enter into any strict system of accounting, and it is therefore difficult to draw a parallel between the cost of operating machines and teams. As stated

above, the motor truck has saved our horses and we find them in much better condition at the end of the season. A horse, like a man, has a limit as to the amount of work that can be accomplished in a day—horses do not respond to an emergency as does a machine, which can be worked day and night in an



One of the Four 5-Ton Pierce-Arrow Motor Trucks Which Have Reduced the Hauling Costs of the Rhodes-Jamieson Co. Nearly 50 Per Cent.

emergency. We have been able, by the use of the motor truck, to improve our service, which naturally results in an expansion of our business, and this must be credited to the general net result in favor of the motor truck.

There is an advertising advantage. Many people are attracted by a well kept, smooth running motor coal truck. Many recognize the humanitarian advantage. Many of our customers objected to the spectacle of a heavy load of coal being hauled by horses up many of the steep grades in our city. So, it is apparent that it is not advisable in all cases to judge the worth of a motor truck strictly from the standpoint of the cost per ton to operate.

Saves One-Half in Cost

Our motor trucks hauling building materials will average about 60 miles per day, and deliver, on an average, 75 tons per day. The cost per mile to operate our machines in this service is 16 cents; the cost per ton-mile 11 cents. The latter cost includes all overhead expense, such as repairs, maintenance, depreciation, insurance and the like, and all operating costs.

We find that our motor truck in this class of work has reduced our cost of delivering building materials as compared with former team delivery nearly one-half; in fact, it would be quite impossible, without rearranging our wards, to handle the present volume of business with teams; it would result in such congestion that the tonnage could not be moved with promptness and regularity.

Our motor trucks are delivering building materials to points 12, 15 and, in some cases 25 miles distant from our yards and making these deliveries with promptness and with profit to ourselves, with the result that our business has expanded to limits that would have been impossible except by the use of motor trucks.

Our early experience has been completely reversed. Our present machines are entirely dependable, always going, and our repair bills are extremely light; in fact, recently we had occasion to overhaul our first Pierce-Arrow vehicle, which at the time had run about 35,000 miles, and to our surprise and pleasure there were very few repairs or renewals necessary and the total expense was light.

Hollow Wall Concrete Construction

The 2-E flexible concrete form is a form used for constructing any hollow or solid wall concrete building at a cost much less than the ordinary expense of construction, where temporary forms of any kind are used, writes the 2-E Flexible Concrete Form Company.

Farm buildings, bungalows, houses, garages, factories, ice houses, foundation walls, etc., can be constructed with this form at a material saving over cement block, tile, brick or wood construction.

It is the simplest, least expensive, and most rapid method of hollow wall construction in existence. One operator can build as rapidly as three men can mix and carry the concrete to the form. There is no delay in waiting for the concrete to set. Simply spread and tamp the fresh concrete in the machine until filled, then raise the lever releasing the machine from the wall, move it forward, reclamp on the wall and repeat the operation.

No wooden forms are required, thereby eliminating the expense of wasted lumber. All lumber that is required is the plumb or corner boards on each corner with the necessary braces for same.

The form is so simple in construction and operation that any person of ordinary intelligence can learn to operate it in one hour.

Hollow concrete walls constructed with 2-E Flexible Concrete Forms are storm safe, fire proof, insulated from heat and cold, and absolutely impervious to moisture, making a very suitable construction for dwellings and many other buildings in which these particular points are very essential.

What the 2-E Flexible Concrete Form Will Build

It will build a hollow concrete wall with continuous air space of $2\frac{1}{2}$ inches.

It will build a hollow concrete wall with solid corners.

It will build a hollow concrete wall with solid pilasters at any desired place in the wall.

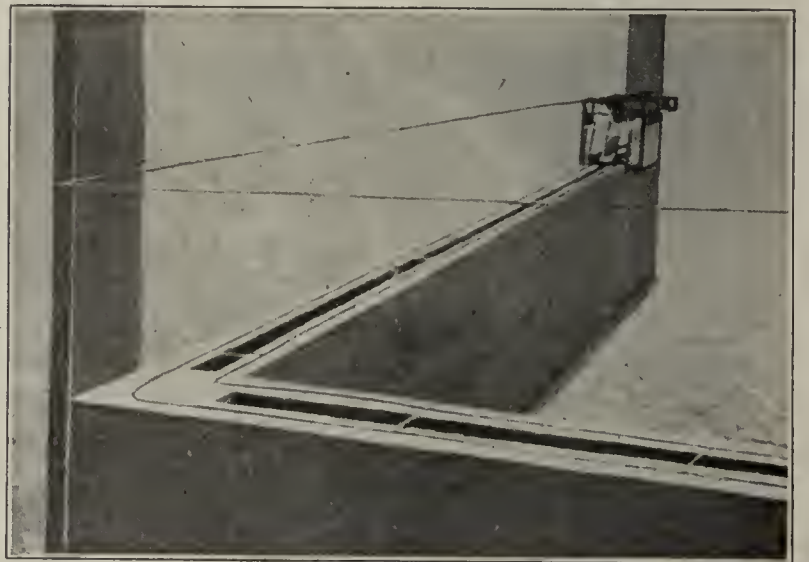
It will build hollow walls of any desired thickness from seven to fourteen inches.

It will build solid foundation or partition walls of any desired thickness from two to fourteen inches.

It will build irrigation ditches, flumes, curbs, posts, columns, and many other forms in which concrete is advantageous.

It builds 10 inches high each course.

The 2-E Flexible Concrete Forms are made of metal.



Simple and Inexpensive Hollow Wall Concrete Construction With the 2-E Concrete Form.

The supporting frames are of a very rigid truss design, and the arms supporting the mold boards are made of flexible spring steel, and will not bend out of shape. This insures the walls being true and straight when completed.

The mold boards are made of heavy galvanized sheet metal and will not bulge, warp or get out of shape in any manner when exposed to the weather. All parts are interchangeable.

We guarantee each form sold and will gladly replace any bent or broken parts caused by defects or weakness in construction. Full instructions for operating will be sent with each form sold. You can try a form at our expense and send it back if you don't find it as we say, writes the 2-E Flexible Concrete Form Co., 692 Centre street, Eagle, Wis. Write for description and prices.

Concrete Swimming Pools

Less than a year ago the Portland Cement Association, Conway building, Chicago, issued a booklet on concrete swimming pools and through its Cement Products Bureau has done very extensive promotion, both of municipal and private pools. As a result we hear of many pools in cities from the Atlantic to the Pacific planned for the coming year. The swimming pool situation is being handled in many cases as are paving propositions, municipal bond issues being arranged to provide the necessary funds for undertaking the construction.

Concrete Culverts

For many years cast-iron pipe has been the favorite material for railroad culvert service. Though still used extensively by some of the more conservative roads, it is fast being replaced by reinforced concrete where materials for its manufacture are readily obtainable. This change is due principally to the considerably smaller cost of the latter type of construction, and in localities where sulphur or acid waters are prevalent to the non-corrosive qualities of the concrete.

Box and Pipe Culverts

Concrete culverts are of two distinct types—box culverts and pipe culverts. The former are constructed in place, usually according to designs prepared by the railroad, and are monolithic in character. The labor involved in their construction and the time necessary for their curing are features which make their use often undesirable. Pipe culverts are made in sectional lengths, varying in diameter from 12 in. to 8 ft. They may be made either on the ground at the point of erection or shipped, ready cured, from some central factory. Owing to better facilities for making and handling, the factory-made product is usually the better pipe. Some idea of the economy of the latter type

acter it is not of equal transverse strength with the body of the pipe.

The thickness of the shell and the shape of the section will vary with the amount and position of the reinforcing used. The illustration shows four general variations of these factors. The type shown in Fig. 1 is satisfactory for small sizes—12 to 18 in. in diameter—where the thickness of the shell is in excess of the thickness necessary to support the loads carried. The steel should be placed at the center of the shell. For pipe more than 18 in. in diameter, to obtain the greatest possible effectiveness of steel and concrete, two rings of reinforcing, should be used—one placed near the inner and the other near the outer surface of the shell, as shown in Fig. 2. If it is possible to determine accurately the direction of the load thrust upon the pipe, a large economy of steel can be obtained by using only a single ring, as shown in Figs. 3 and 4. Since it is difficult to hold an elastic ring of steel in any shape other than a true circle, the latter of these two types is more commonly used—the steel being circular and the concrete section sufficiently elliptical in shape to produce the desired transfer of the reinforcing from the inside to the outside of the shell.

COMPARISON OF COSTS OF STANDARD CAST-IRON AND REINFORCED-CONCRETE CULVERT PIPE

Inside Diameter, in.	CAST IRON				REINFORCED CONCRETE			
	CLASS A, LIGHT		CLASS B, MEDIUM		CLASS C, STANDARD		CLASS D, EXTRA HEAVY	
	Weight	Price	Weight	Price	Weight	Price	Weight	Price
12	72.5	\$1.37	82.1	\$1.56	91.7	\$1.74	100.0	\$1.90
15	100.0	1.90	113.7	2.16	130.0	2.47	144.0	2.74
18	129.2	2.45	150.0	2.85	175.0	3.31	191.7	3.64
24	204.2	3.87	233.3	4.43	279.2	5.31	306.7	5.83
30	291.7	5.52	333.3	6.33	400.0	7.60	450.0	8.55
36	391.7	7.43	454.2	8.61	545.8	10.37	625.0	11.88
42	512.5	9.74	591.7	11.22	716.7	13.61	825.0	15.67
48	666.7	12.67	750.0	14.25	908.3	17.25	1050.0	19.95
54	800.0	15.20	933.3	17.70	1141.7	21.68	1341.7	25.50
60	916.7	17.40	1104.2	20.98	1341.7	25.50	1583.3	30.08
*66	1100.0	20.90	1325.0	25.18	1623.0	30.85	.....	.....
72	1283.0	24.40	1548.8	29.43	1904.2	36.18	.....	.....

*These sizes of cast-iron pipe not made; prices on them are approximated simply as a comparison. Cast-iron weights shown above adopted as standard by American Waterworks Association, May 12, 1908. Cast-iron prices based on current quotations of \$38 per net ton, November, 1916. Reinforced-concrete weights and prices averaged from manufacturers' standards.

of construction can be obtained from the accompanying table, which lists the various sizes, weights and prices of cast-iron and reinforced-concrete pipe.

Two Grades of Concrete Pipe

Concrete pipe is made in two grades, the heavier being intended for service under track, while the lighter is used for longitudinal drains at grade crossings, or at any other point not directly beneath the track. No broad specifications have as yet been generally adopted leading to uniformity in the manufacture of this product, consequently considerable variation in the standards for length, type of joint, section and reinforcing of different manufacturers are noticeable.

Unit lengths on concrete pipe vary from 4 to 8 ft., as compared with 12 ft. for cast iron. It is claimed for the shorter lengths that they are easier to handle, will combine readily to form a culvert of any length, and are of particular advantage for maintenance work under a multiple-track roadbed, as they can be lowered between adjacent tracks without displacing the ties or interrupting the service.

Several types of joints are furnished by different manufacturers, with the common "bell and spigot" predominating. So-called "lock joints" are made with a variety of detail, the lock feature being obtained by the overlapping of the reinforcing for an inch or two at the joint, or by the filling of a groove in the joint with mortar. It is doubtful if these are of sufficient bonding or shearing strength to be very effective, and as this type of joint is usually of the "shiplap" char-

The position of the reinforcing, as shown in these latter figures, is correct for a theoretically vertical load. Any material variation of the line of thrust from the vertical will greatly reduce the effectiveness of the reinforcing. Should the thrust become horizontal, or the pipe inadvertently be placed with its major axis horizontal under a vertical load, the pipe would develop but slightly greater strength than plain concrete. It is evident that the proper placing of pipe reinforced in this manner is a problem of some nicety and not at all fool-proof. An additional disadvantage of the type illustrated in Fig. 4 is the fact that its shape will not permit of its use in extending existing culverts of cast iron or any pipe of circular section.



FIG. 1

FIG. 2

FIG. 3

FIG. 4

FOUR VARIATIONS IN CONCRETE-PIPE REINFORCEMENT

Thickness of Shell

Concrete pipe having a shell three times as thick as a cast-iron pipe of the same nominal diameter, or having the same weight per linear foot, is capable of supporting the same loads if properly made and reinforced. About 0.8 per cent of tensile reinforcing is the proper amount to produce a reasonable relation of stress in steel and concrete for pipes having this thickness. The

reinforcing steel may consist of rods forming separate rings, some type of mesh, or continuous spirals. In the first two cases sufficient lap must be allowed to insure the steel taking full stress at any point. In any case the distribution of the metal throughout the length of the pipe should be unusually thorough, due to the vibratory character of the loads. The exact amount of the reinforcing will of course depend upon the thickness of the shell, and vary inversely with it; the more recent, and probably more logical, tendencies point toward the use of thinner shells and more reinforcing.

Getting There First

It is easy enough to follow along with the crowd, to be one of the imitators and to take chances in a business from which the pioneers have skimmed the cream of the profits. It is a whole lot better, in our opinion, to be one of the leaders, to be a little in advance of the band wagon and show your friends, neighbors and clients that you can think for yourself as well as keeping fully informed on everything new in your line.



A Model Concrete Silo Built Rapidly and Inexpensively With Polk Forms.

Every farmer now realizes that a silo is a business necessity and that he cannot make much of a profit on his farm without a silo. Yet we see many contractors who are standing idly by and letting the silo business get away from them. This business belongs to the contractor, and he is a poor contractor who allows any of it to get by him without at least figuring on the job.

When it comes to figuring on the concrete silo, however, he should see to it that he knows what he is doing and that he can complete it within the time required. To do this he must have proper equipment, equipment designed for silo construction.

Polk-Genung-Polk Company, Ft. Branch, Ind., have designed an apparatus and equipment for erecting silos. They have made a specialty of this equipment and they believe that a contractor should have no difficulty in cornering all the business in his vicinity when he uses their equipment. Their large catalog shows some of the points of superiority of the Polk system and should be carefully read by every one of our readers. It will be sent free on request and it will show how the contractor is benefited by following the Polk system of construction.

Ideal Service

The careful buyer of concrete products machinery today investigates the service offered by the firm he intends to deal with before investing his money, for in the service is reflected the firm's responsibility, its interest in its customers' success and its confidence in the machinery that it sells.

If the prospective purchaser would investigate the service offered by the Ideal Concrete Machinery Company, 1353 Monmouth avenue, Cincinnati, Ohio, he could not fail to be convinced that Ideal Concrete Machinery is a good investment, even though he had never seen the machinery itself.

Ideal service begins with the prospect's first inquiry. He receives information on concrete block construction, tables of materials required, and, in fact, full data on the manufacture of blocks. Then, if he wants it, the engineering department submits a drawing of his plant, so arranged that concrete products can be manufactured economically. He also receives an estimate of the cost of the equipment required. When he orders Ideal equipment he receives full instructions for installing and operating it.

If the customer orders power machinery, the Ideal Concrete Machinery Company installs it themselves and instructs the customer in its operation. This installing service is free to purchasers of Ideal Power Machinery within a radius of 300 miles of Cincinnati. Beyond that distance the company only makes a charge for the extra time and expense in covering the distance beyond the 300-mile limit.

Ideal service does not, however, end with the sale of the machinery. They assist the customer in handling the problems that will naturally arise in manufacturing blocks and will also help him to market his product successfully through practical suggestions.

The Ideal Concrete Machinery Company feels that the expense of maintaining this service is justified as it has convinced the trade that the Ideal Company stands behind its machinery, makes a reliable product, and is interested in the success of its customers.

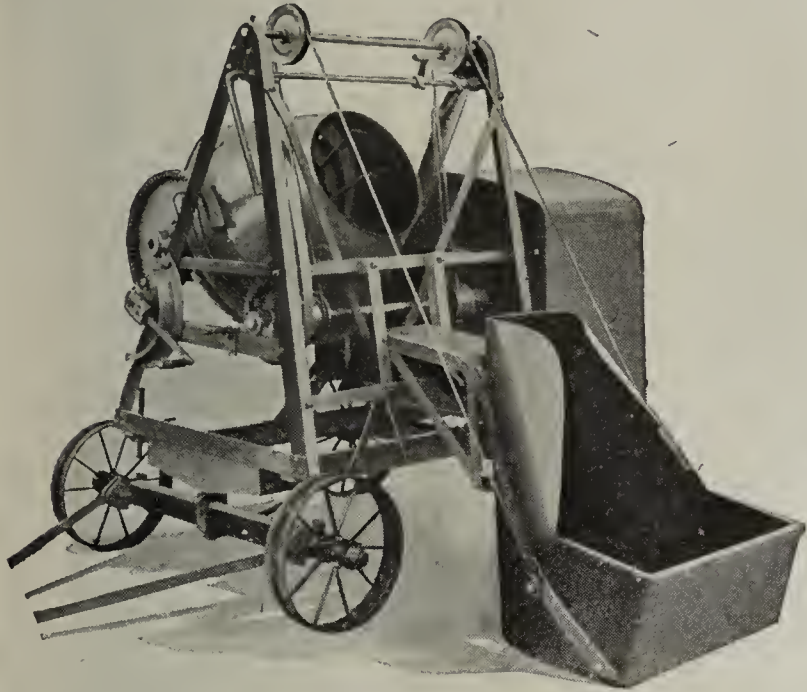
The "Boss" Concrete Mixers

The American Cement Machine Company, 9635 Johnson street, Keokuk, Iowa, has issued an attractive catalog entitled "Specifications," which relate to the leading lines of concrete mixers turned out by this concern. Special reference is made to the "Boss," which embodies a high speed "Re" mixing action which it is claimed mixes and discharges the concrete faster than is usually the case and with fewer drum revolutions. It is claimed that a batch may be mixed in 15 seconds and discharged in from 10 to 15 seconds owing to the fact that the discharge spoon extends nearly two-thirds the way through the drum and every one of the deep scoops or buckets discharges into it. The claim is also made that the machine will mix concrete, grout or semi-dry mortar and plaster. It is practically self-cleaning, and its constructive features are such as are likely to interest contracting-builders generally. It is made in sizes and styles to meet varying requirements and in the catalog in question full information concerning the salient features is set forth. Attention is also called to the "Boss" hoisting attachment, and to watering devices for concrete mixers. A page of the catalog is given up to detailed tables of capacity and weights of "Boss" mixers; also diagrams showing the general dimensions.

JAEGER

BIG-AN-LITTLE

MIXERS



Everything a batch mixer ought to have is contained in this machine.

Our Tilting Drum guarantees a perfect speedy mix—single opening, large capacity, easy to load and unload and always clean.

The Drum is entirely open to view at all times.

The Mixer has proven by test to be most economically operated.

And, don't forget, you get A MIX A MINUTE.

Our new folder shows the entire line.

Write for your copy now.

THE JAEGER MACHINE COMPANY 212 W. RICH STREET COLUMBUS - OHIO

Five Austin Drum Mixer Features—

1. **Wide loader and opening** into drum permit fast charging without clogging.
2. **Design of mixing blades** is such that the mix is carried over on discharging chute very wet, allowing rapid discharge, either entire batch or part.
3. **4-H. P. hopper-cooled** gasoline engine, or steam or electric power. Twenty-gallon steel water tank and steel engine housing.
4. **One position control.** Capacity, 60 to 80 cu. yds. per day.
5. **Designed and constructed** throughout to maintain the high-quality reputation earned for its manufacturers by their Austin Cube Mixers.

Municipal Engineering & Contracting Co.

Main Office: Railway Exchange Bldg., Chicago, Ill.

New York Office: 30 Church Street
New England Agents: Dyar Supply Co.,
Cambridge, Mass.

Pacific { J. H. Hansen & Co., San Francisco
Coast { Howard, Cooper Corp., Portland
F. S. Burbank Co., Seattle.

E. Canada, A. A. Scully, Stair Bldg., Toronto

Discharge Side of
No. 1 Austin
Drum Mixer



"Concrete for
Permanence"

**Municipal Engineering
& Contracting Co.**

Railway Exchange Bldg.
Chicago

Send me catalog No. 21-D. I want to know more about high-grade, low-priced drum mixers and pavers made by the builders of Austin Improved Cube Mixers.

Name.....

Address.....

SIGN, CLIP HERE AND MAIL

Gravel Washing in Louisiana

The Morgan Sand & Gravel Company, J. E. Morgan, president, recently completed a modern gravel washing plant on the Louisiana & Arkansas Railway, four miles out of Sibley, Louisiana, and now are producing twenty carloads of washed sand and gravel every work day of ten hours.

The other officers of the Morgan Sand & Gravel Company are, T. E. Flourney, vice-president, and O. B. Morton, secretary and treasurer. The former is president and the latter, cashier of the Ouachita National Bank

Semi-Portable Gravel Washing and Screening Plant

A working model of a small, semi-portable gravel washing and screening plant was on view in the joint exhibit of the cement companies at the Tenth Annual Cement Show in the Coliseum. The actual plant was designed with particular reference to the needs of contractors building concrete roads who wish to prepare their sand and pebbles from suitable material in gravel pits in the vicinity of the road to be built. It was the



Loading Western 6-Yd. Dump Cars With Gravel at the Plant of the Morgan Sand & Gravel Co.

of Monroe, La. Peter Morgan, brother of President Morgan, is stationed at Mt. Morgan in charge of operations. E. L. Lanning is superintendent of the plant.

At Mt. Morgan the company owns six hundred acres of gravel and employs fifty men. The operating equipment consists of two locomotives, two steam shovels, with six-yard Western dump cars, two 35-horse power oil burning engines, a steam pump, three miles of standard gauge railroad and a very fine washing plant, with Stephens-Adamson revolving screens.

There are two pits. In one, ballast for railroad work is loaded with a steam shovel. In the other, material intended for the washer is loaded with a model 61 steam shovel. The 3-mile railroad, which leads from the pits to the washing plant and down to a junction with the main line at Mt. Morgan, is perfect.

The material is dumped into a hopper at ground level; thence carried up to the revolving screens by a belt conveyor.

Perfect as this gravel plant is, it soon will be a secondary one in the operations of the Morgan company. So great has been the demand for Morgan sand and gravel, the company recently purchased a large concrete washing plant at Monroe, La. This is being overhauled throughout and converted into a 16-screen washer. The purchase included two locomotives, a steam shovel and four and a half miles of track. The gravel at Monroe is of a very excellent quality, being about eighty per cent rock. At the time the purchase was made the company had contracts amounting to about \$100,000, including one for ballasting eighty-eight miles of county roads.

intention to make the plant as nearly portable as possible, and at the same time low in cost.

The screen capacity of the plant is 350 cubic yards and the capacity of the two bins is 22 yards of pebbles and 18 yards of sand, respectively.

It is estimated that properly washed and screened sand and gravel can be produced at an approximate cost of about 60 cents per cubic yard of material in



Gravel Washing Plant of Morgan Sand & Gravel Co.

the bins, although the exact cost will be governed by the cost of labor, teams, water, etc., and also by the relative proportions of sand and pebbles in the pit.

Blueprints showing the details of the plant can be obtained through the Portland Cement Association, Conway Bldg., Chicago.

STREICH Dump Wagons



1. Chicago Second Regiment Armory Job.
W. J. Newman, Contractor.

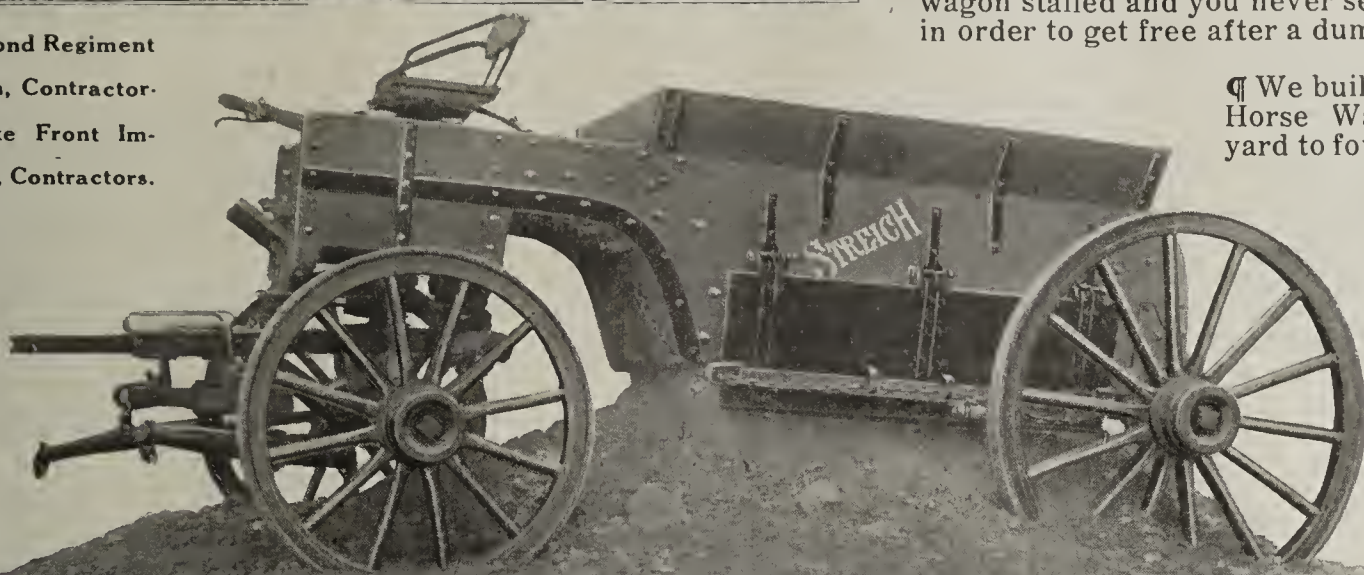
2. Chicago Lake Front Improvement.
The Ryan Co., Contractors.

¶ About 90% of the Dump Wagons purchased in the City of Chicago are Streich's. There is a reason. Our wagons run easily because the axles are properly set, and wear long because they are made of the right kind of stuff.

¶ This wagon will dump anything from cinders to the stickiest kind of clay. Weight of contents of load when dumped automatically forces the bottom doors up the sides of body, allowing bottom doors to clear pile. You never see a Streich wagon stalled and you never see a driver shovel in order to get free after a dump.

¶ We build One and Two Horse Wagons from one yard to four yards capacity.

Write for catalog showing complete line of Dump Wagons, Garbage and Asphalt Wagons.



A. STREICH & BRO. COMPANY OSHKOSH, WISCONSIN.
CHICAGO OFFICE: 663-665 WEST LAKE ST.



BULLETIN No. 1 covers the possibilities of Drain Tile as a business. This includes materials required, complete costs, selling prices and profits. It tells what others are doing in this business. How the demand is rapidly increasing and why cement tile are preferred by users.

BULLETIN No. 2 covers manufacturing. How to successfully start and operate a tile plant. Points to consider regarding location and building. Arrangement of equipment for best production. Describes different curing methods and relative costs. Tells what proportions of materials should be used and how mixed.

BULLETIN No. 3 deals with selling the product. Best methods to use for securing local business. How to get business from nearby towns. It also illustrates advertisements for use in local newspapers.

The Tile Business Fully Described

This instructive book on cement tile completely covers the three big subjects: **Possibilities of the Business, Manufacturing and Selling.**

It also describes suitable equipment for both large and small plants. For small plants as well as general cement products plant we recommend the Dunn No. 1 Machine, because it can be easily installed, occupying little space and can be operated successfully and profitably by 1, 2 or 3 men.

For large plants we have the Dunn Automatic, which makes a larger tile and has a larger capacity.

We Want Only Successful Plants. We investigate local conditions for any prospective purchaser. If not right, we advise you not to buy. If right, we go the limit with you. We try to eliminate failures. They are not necessary. We cannot afford that risk any more than you can, as every sale we make is absolutely on our 15 days' free trial offer—your money back if not satisfied.

Write today for this tile book. We send it absolutely free.

W. E. DUNN MFG. CO.

414 24th Street

HOLLAND, MICH.

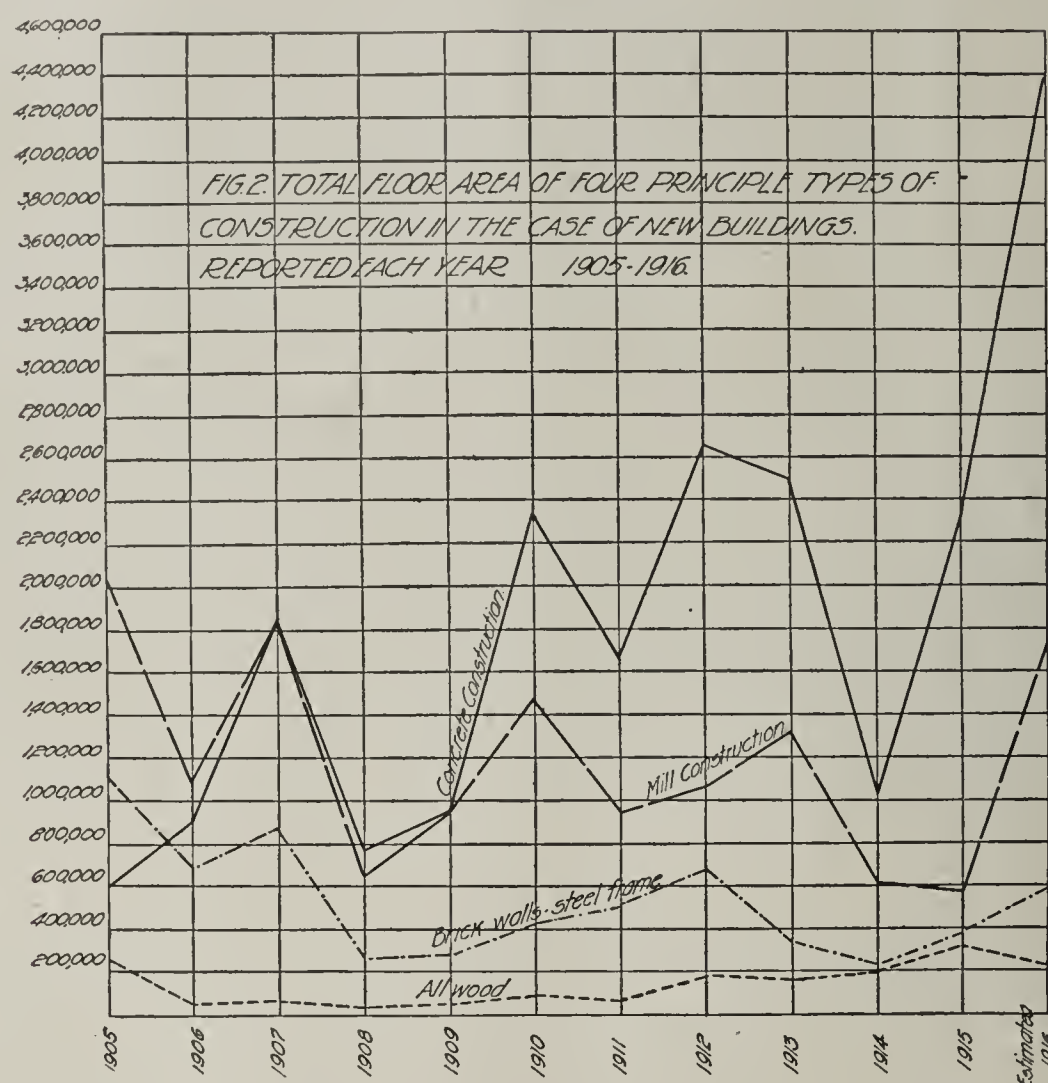
Recent Tendencies in Industrial Building Construction

The present trend of industrial building construction is indicated by a recent investigation made by W. P. Anderson, president of the Ferro Concrete Construction Co. of Cincinnati, and presented in a paper before the recent annual meeting of the American Concrete Institute in Chicago.

The results of Mr. Anderson's investigation were drawn from inquiries made of the leading industries, manufacturers of all classes of metal goods, brewers, manufacturers of textiles, paper, leather, boots and shoes.

Appointed Sales Manager of New Cement Company in Argentine

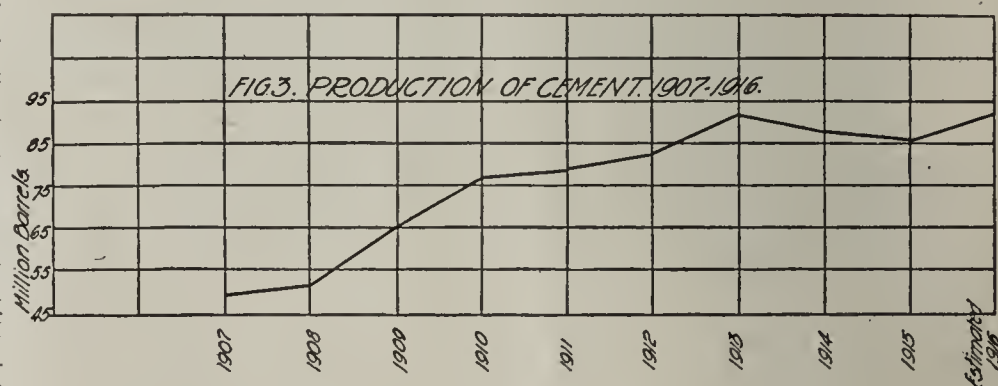
Arthur C. Hillegass, of Allentown, Pa., who about ten years ago, as a boy of fifteen, started as a clerk at the Atlas cement plant, has just been appointed sales manager of the great plant being built by the International Cement Co. of New York, at Sierras Payas, Argentine Republic, and will sail for South America early in April. From the Northampton plant of the Atlas, Mr. Hillegass was promoted to the plant at Hudson, N. Y., and later in that town has had charge of the Pittsburgh testing laboratory.



Of the representative manufacturers who were requested to furnish data, 370 concerns contributed information covering 1,230 buildings erected during the period covered by the investigation. These varied greatly in size, use and construction, but all were used for industrial purposes.

The returns year by year are graphically represented in the accompanying chart for the four major classifications—all wood, brick walls (steel frame), mill construction, concrete construction. Of course, the abnormal disturbances during 1914-16 account for the great fluctuations in that period. But even up to and including 1913, the advance of concrete construction and the relative decadence of other types are distinctly noticeable. The comparative growth of the various types of building construction is most strikingly shown by comparing the periods 1905-1910 and 1911-1916. In the former the returns cover 7,014,218 square feet of mill construction and only 5,152,579 square feet of concrete construction, but in the later period the area of construction jumped 327 per cent to 16,926,152 square feet while the mill construction showed a bare increase of about 10 per cent to 7,709,469 square feet. The estimated area for 1916 was used in making up all of these comparisons.

The International, which is completing a mill in Cuba, plans a five-thousand-barrel a day plant at Sierras Payas, which is about 200 miles from Buenos Ayres on the Trans-Andean Railroad. The plant will be erected in two units, and it is expected that the product will be used chiefly in Buenos Ayres, where Sales Manager Hillegass will have his headquarters. The plant,



at least a two million-dollar enterprise, will be finished in about a year, by which time it is expected he will have learned Spanish and accustomed himself to the ways of the country, sufficiently to do business.



Republic

Select Your Outfit According to Your Needs

New 1917 Models

No matter what your requirements may be, you will find an outfit in the Republic Line that will suit you, whether it be for a small, light, cheap machine — a medium size — or a full size outfit — mixers that have made good and will prove the most profitable, sensible mixers for you to buy.

Prices

Republic prices are extremely reasonable; for instance, a hand mixer for \$40.00 — "The Little Builder" for a little over \$100. Other prices proportionately low. They represent the biggest value ever offered for good, reliable, well-made machines — and will fit your purse.

Terms

Republic Mixers are sold on cash or time basis to responsible parties. You cannot afford to be without one of these machines, purchasable on our liberal selling plan.

Guarantee—Write your own guarantee. You take no chances when you buy Republic machinery, as they must make good or we will. It avoids any dissatisfaction on your part.

Free Catalogs—Write for catalogs today.

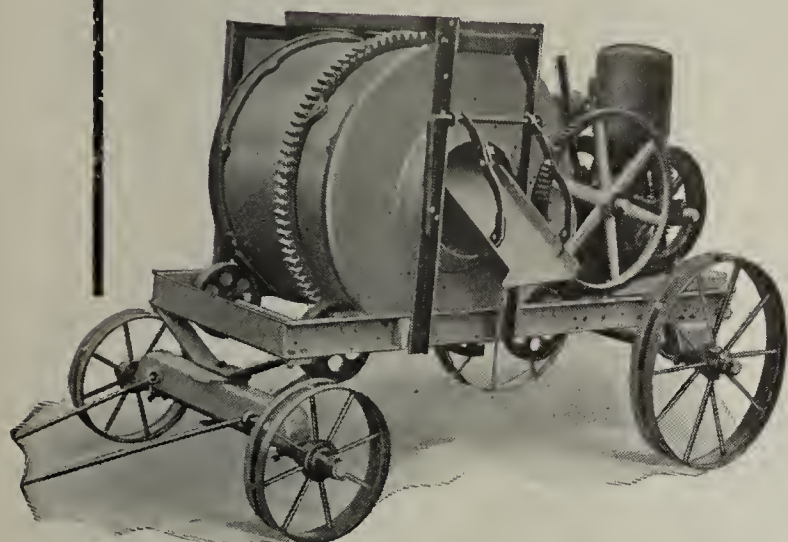
It does not obligate you to buy but will show you the latest and most up-to-date machines built and sold at prices you can afford to pay.

Republic Iron Works

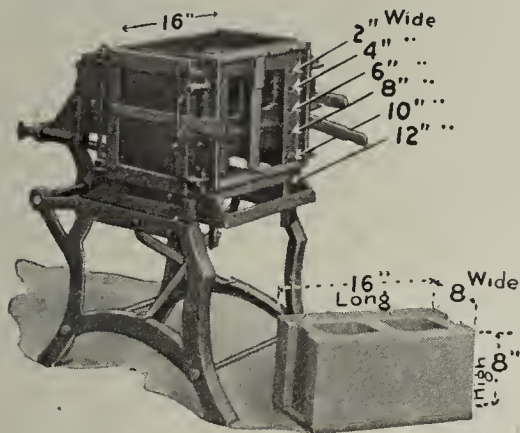
Tecumseh, Mich.

116 Patterson St., or Box 454

Mail This Coupon Now

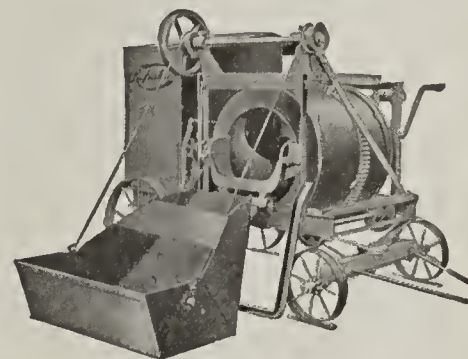
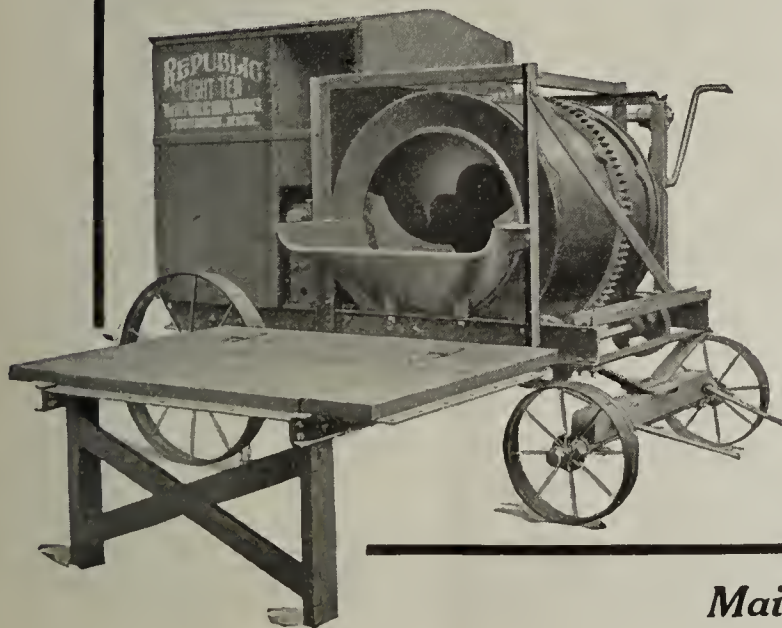


REPUBLIC "5" and "7"
Loaders, Hoists, Tanks, Pumps or
other attachments

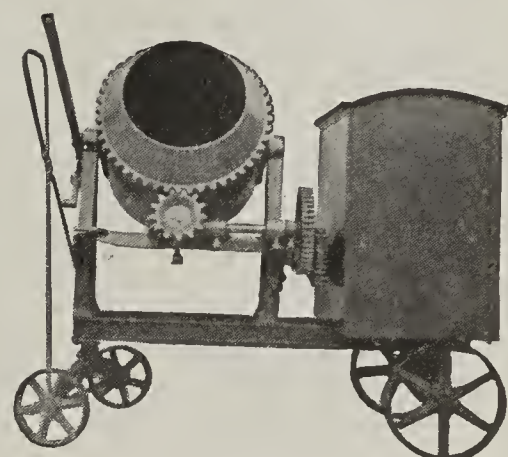


MONARCH BLOCK MACHINE
Adjustable to all sizes

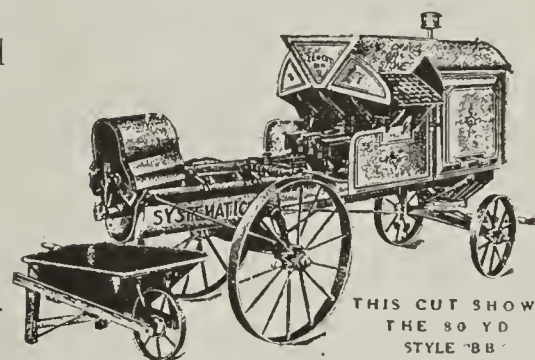
THE LIGHT "10"
Low Charger



LIGHT "10" Loader Outfit



REPUBLIC "3" Little Builder



SYSTEMATIC AUTOMATIC
Four Sizes

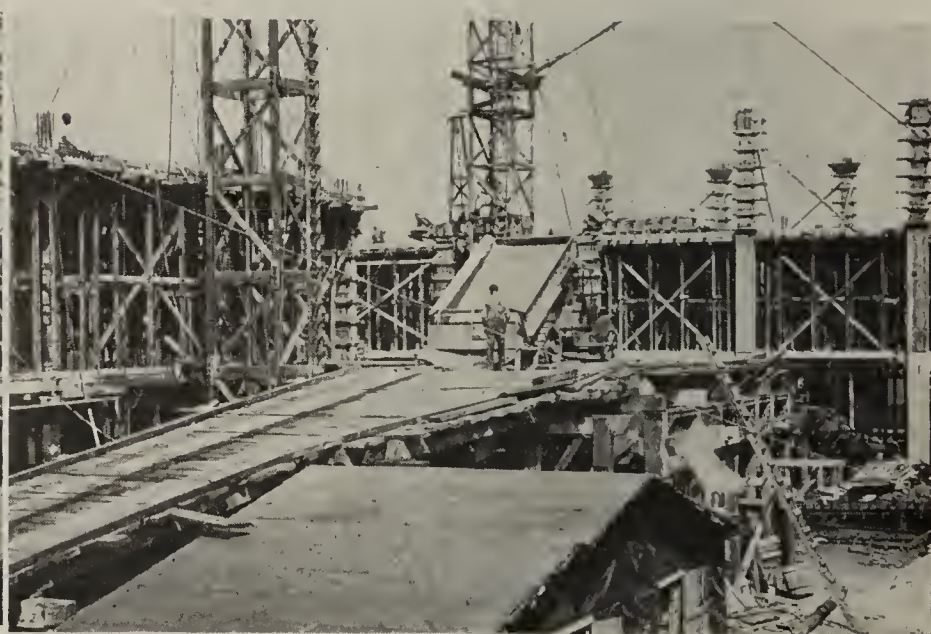
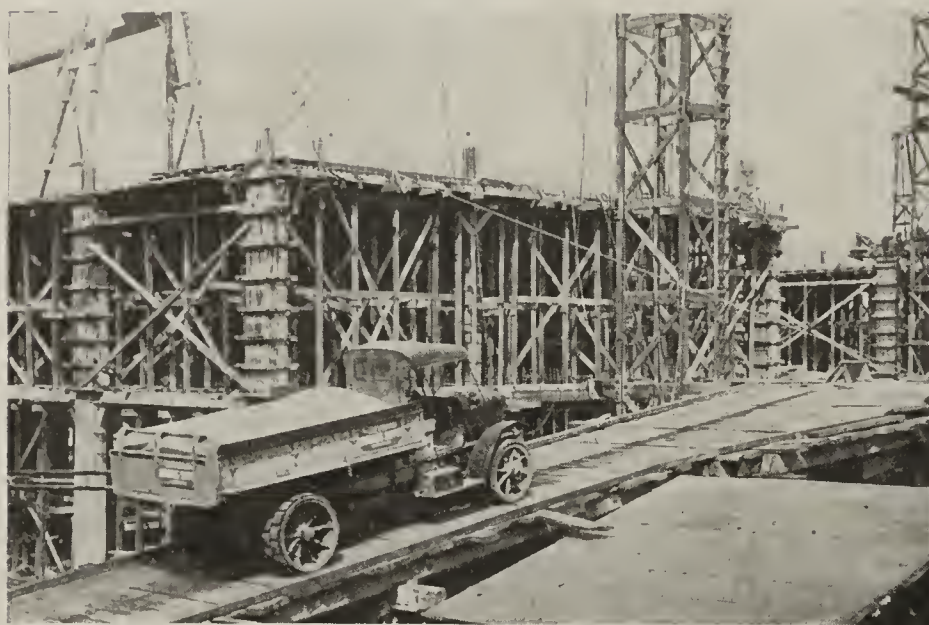
Gentlemen: Please mail me catalog today on
I expect to be in the market about

Loading Platform

Many building contracts are figured on a time basis and the speed and increased efficiency with which cement, sand, slag, gravel and crushed stone may be handled by the use of motor trucks has saved large sums for the contractors.

Very often on big jobs special devices for loading and unloading have been constructed to facilitate the operation of the machines and a striking example of this is the system employed by the Cleveland Builders' Supply Company on the construction of the new \$500,000 building for the Richman Brothers Company, Cleveland.

The structural work of this building is largely concrete and many tons of sand, cement, and gravel are mixed daily. In order to do this work as speedily as possible, the contractors have built a platform of heavy wooden beams on a level with the second story of the structure. Leading up to this platform are two inclines



One of the Builder's Supply Company's 5-Ton Motor Trucks Climbing Specially Built Loading Platform and Discharging Its Load.

built of heavy planks and with a grade of 10 per cent. The company's motor trucks with their 5-ton loads are driven up the incline on one side of the platform. The loads are dumped through an aperture in the platform, and the machines are driven across the platform and down the incline on the other side.

In this way they are kept running continuously and no time is lost in backing and maneuvering around to find the most advantageous place for dumping. Contractors have highly praised the platform device and say that it saved a great deal of time and money. The company owns nine 5-ton motor trucks.

Simplicity in Catalogs

W. L. Chandler of the Dodge Manufacturing Company of Mishawaka, Ind., is a member of a committee of the National Association of Purchasing Agents, who advocates uniformity and simplicity in catalogs. Instead of asking purchasing agents to keep on hand practically a shifting library of catalogs, he advises a master catalog. He says that under the present system many of these separate catalogs contain the same information. He also says that in other cases it is necessary for a busy purchasing agent to wade through hundreds of pages of irrelevant matter, only to come to unsatisfactory information on the subject he wants. To do away with this complexity, the committee is trying to simplify the matter of catalog printing. He has issued a long statement on the subject, which is called "A Buyer's Prophecy." It makes mighty interesting reading to those who are using catalogs.

Utah Cement Factories Oppose 8-Hour Law

Arguments against the enactment of an eight-hour law which would affect cement factories were heard yesterday by the senate committee on public health and labor of Utah. L. M. Bailey of the Utah Portland Cement Company represented the cement producers. He asserted that with the exception of machinists all employees of the cement concerns now work twelve hours a day and are paid by the hour. The machinists work nine hours a day.

Mr. Bailey declared that the men would resent a curtailment of the number of hours unless the same rate should be paid as for the twelve-hour period, and this, he declared, would seriously limit the production of the plants, which work now only about 70 per cent of the time. The additional cost, he asserted, would prohibit the Utah concerns from competing with the cement producers of other states.

Illinois Cement Mills Are Rushed

There is great promise for the cement industry in Oglesby, Ill., for the season just opened and both the Lehigh and Marquette Cement mills will exceed their output of former years by a large margin, according to present indications. The only thing that is crippling them now is a lack of cars, and the shortage is a serious matter.

Many improvements are to be added during the present season, especially at the Marquette plant, where an open quarry will soon be in operation, a bridge built across the Vermillion River and at the main plant enlarged to nearly twice its present capacity.

The Marquette Cement Company will adopt the 8-hour shift for workmen. All continuous operations for 24 hours will be placed upon the basis of three 8-hour shifts.

Tycrete Colors (Dry)

Tycrete colors are specially prepared under our secret formula for use with Tycrete Concentrated Waterproofing Compound, writes the Ideal Concrete Machinery Company, 1353 Monmouth avenue, Cincinnati, O. Ordinarily it is not safe to use over ten per cent of coloring with Portland cement, but with Tycrete Concentrated Compound and Tycrete Colors we have succeeded in using as high as twenty per cent coloring with satisfactory results. The amount of coloring to be used depends on the shades desired. For deep colors, it is necessary to use more coloring than for the lighter shades. Tycrete Colors are shipped in 25-pound cans and larger sizes.



City of Cleveland using Plymouth Locomotive to build water tunnel system

City Cuts Haulage in Tunnel Job

Cleveland, Ohio, is building its own pure-water tunnel of cement blocks. Commissioner C. F. Schultz tells of replacing a compressed-air motor with The Plymouth at a saving of more than 50% in cost of haulage operation.

The Plymouth Friction-Drive Gasoline Locomotive Cuts Haulage Costs One Half

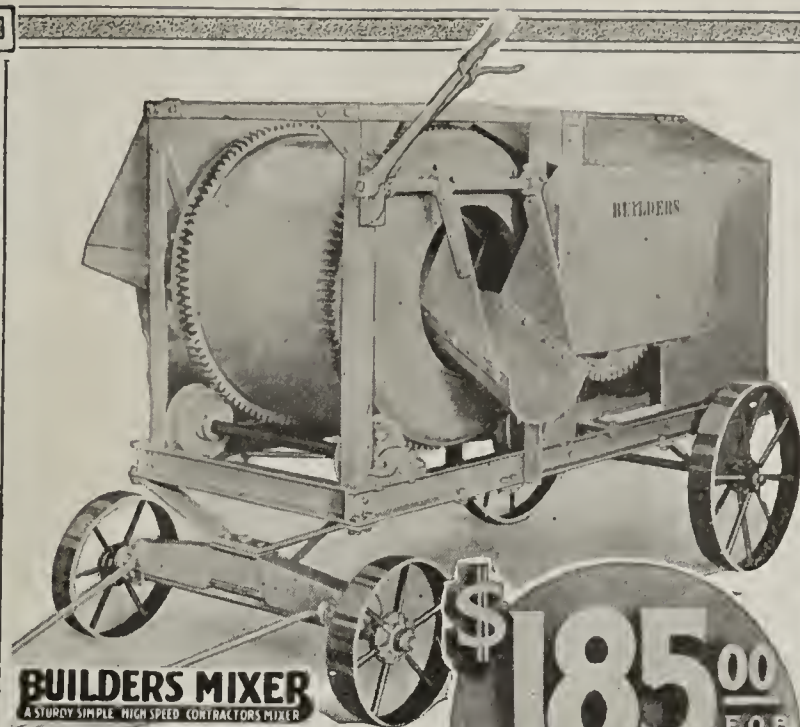
It costs less to buy, less to install, less to operate and less to maintain. It takes heavier loads up-grade, uses full power of motor in low as well as high, gives any speed up to 12 miles without shifting of gears, and moves quicker without jerk or jar.

Commissioner Schulz Proves All This

"The Plymouth Locomotive costs us one-third less to install, 52 cents a day for gasoline and 3¼ cents a day for lubricant, while coal for the compressed air motor cost us \$1.50 a day—a difference of 68 cents a day in favor of the Plymouth," says Mr. Schulz. "We consider The Plymouth is cheaper to operate than an air motor, horses or any other power-driven system."

THIS BOOK TELLS It gives the story of this particular installation and some 34 other installations, with cost data and valuable information regarding haulage problems similar to your own. Your copy is ready—send for it today.

THE J. D. FATE CO., 220 Riggs Avenue, PLYMOUTH, OHIO



BUILDERS MIXER
A STURDY SIMPLE HIGH SPEED CONTRACTORS MIXER

A Sensation!

Patented High Speed Mixing and Discharge Action. Steel Construction. Double Gear Drive. A REAL BARGAIN

\$185.00
F.O.B. KEOKUK
BUYS THIS "HALF SACK" LOW CHARGER

ASK ABOUT OUR "NEW YORK SPECIAL" GASOLINE PAVER

Write or wire nearest office for prices and terms

THE AMERICAN CEMENT MACHINE CO., INC.

HOME OFFICE AND FACTORY

New York
Philadelphia
Baltimore
Richmond
Pittsburgh
Indianapolis

Keokuk IOWA U.S.A.
THE 300,000 H.P. ELECTRIC CITY

Chicago
Minneapolis
Seattle
Spokane
Los Angeles
New Orleans

Stock Carried in Principal Cities for Prompt Delivery



DON'T CUSS!!

IT does not pay to waste your time and temper on a poor mixer. Your concrete mixer is the heart of your force. Everything else depends upon its successful operation.

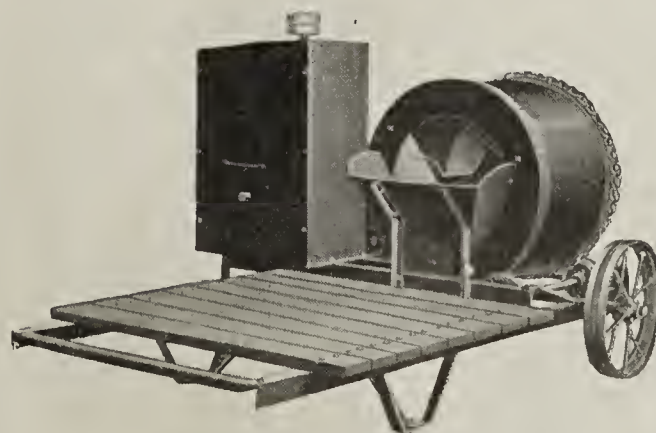
Use Ideal Cincinnatus Batch Mixers!

They are reliable and do thorough work. They are compact and easily handled. Made in 5, 7, 10 and 14 cu. ft. sizes, with wheelbarrow hopper, batch hopper and power side loader equipments for general contracting. Also made in 7, 10 and 14 cu. ft. sizes as rear discharge tractor paving mixers.

Send for catalog No 27 and get our reasonable prices

IDEAL CONCRETE MACHINERY CO.

1353 Monmouth Avenue CINCINNATI, OHIO
WINDSOR, CANADA



No. 5 Two-wheel outfit, low-charging, with large, roomy loading platform built on. Just the mixer for small contracts

Sasgen Derricks

The new plant of the Sasgen Derrick Co., which has recently been completed, is located at Grand and Albany avenues, Chicago, Ill. Its construction was made necessary by the rapidly expanding business of the company, now the largest manufacturers of derricks in the United States.

The new plant is on the St. Paul Railroad, and is 57 by 207 feet in size. It is of reinforced concrete construction and it provides in addition to the greatly increased factory



space commodious quarters for the company's general offices and a modern garage. The first story of the two-story section will contain the machine shop and the stock rooms, and the offices and sales rooms will occupy the second floor. The carpenter department occupies the one-story section.

The factory throughout has been designed and constructed on the modern efficiency basis and the owners can now, better than ever before, turn out the high grade products for which they have become noted, besides operating the plant on a more economical plan.



The Latest in Portable Circle Swing Derricks. Boom Can Be Removed in a Few Seconds. Can Take The Derrick to Job in Automobile.

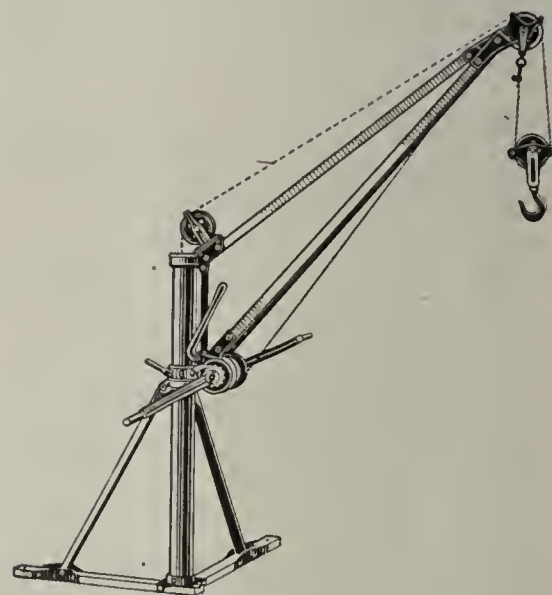
The officers of the Sasgen Derrick Company are M. J. Sasgen, president; M. T. Sasgen, treasurer, and Albert Gloor, secretary. The business of the company began some years ago under the firm name of Sasgen Brothers, and it has been one of continual growth. One of the policies which the company has pursued is never to accept orders which it cannot fill. The same policy will no doubt be continued, but with the new facilities the company can make prompt shipments of a much heavier output than was possible in the old quarters. A line of larger derricks than previously manufactured will be made.

Circulars fully illustrating and describing the Sasgen Circle Service counterweight derricks—still legged derricks, setter derricks, pole derricks, etc., will be mailed on request.

The Sasgen new Steel Champion portable circle swing builders' derrick, for hand, horse or power, shown here-

with, weighs only 200 lbs. It has a capacity of 1,000 lbs. Height 7½ feet, boom extends 5 feet. The boom can be removed in a few seconds by loosening one nut and raising boom 2 inches. Bottom sills and mast fold together, making the derrick in two parts, compact enough so that a contractor can take the derrick to a job in his automobile. For loads up to 1,000 lbs. this Steel Champion cannot be excelled by anything on the market.

Write the Sasgen Derrick Co., 3209 Grand avenue, Chicago, for their catalog No. 15.



Sasgen's New Steel Champion Portable Circle Swing Builders' Derrick, for Hand, Horse or Power.

Hydrated Lime and Its Advantages in Concrete

Considerable literature is being published advocating that small percentage of hydrated lime is used in concrete. The advantages which are claimed for the hydrate lime, and which are backed up by actual demonstrations in the field, are truly worthy of the earnest attention of every engineer. No admixture to cement for concrete has met with more general favor in recent years than hydrated lime. It is a standard commercial product and is covered by standard specifications of the American Society of Testing Materials. When mixed with water it is the most plastic of any building material. Small percentages of hydrate used in concrete give added plasticity to the mixture, make it flow down spouts without the use of too much water, so that the possibility of segregation in handling and placing it is greatly reduced. It makes concrete work better in the forms.

These features are all demonstrated actions and help to produce the all important factors of good concrete—uniformity, density and impermeability. These facts should excite the attention of engineers to the possibilities of service which hydrated lime offers.

Fits up an Office in Concrete Stave Silo

A recent issue of Popular Mechanics tells how a western silo contractor, in need of an office, hit upon an idea which furnished him not only with an office, but with considerable free advertising. Instead of the usual office building, he built a cement stave silo, capped it with the type of roof commonly seen on silos, and fitted it with windows and doors. The silo office proves most convenient in showing prospective customers the details of stave silo construction.

A HINT FOR YOU

THE contractor who is equipped to build monolithic concrete grain storage, water tanks, coal pockets, silos, and silo-water tanks is the contractor who is busy all the time—and prosperous. The POLK SYSTEM supplies such equipment all in one. If you wish, we will send a handsomely illustrated booklet and other valuable information free of cost or obligation. A postal card will do.



Permanent Exhibit—Builders' Exchange Floor

Booths 133 and 134, Insurance Building

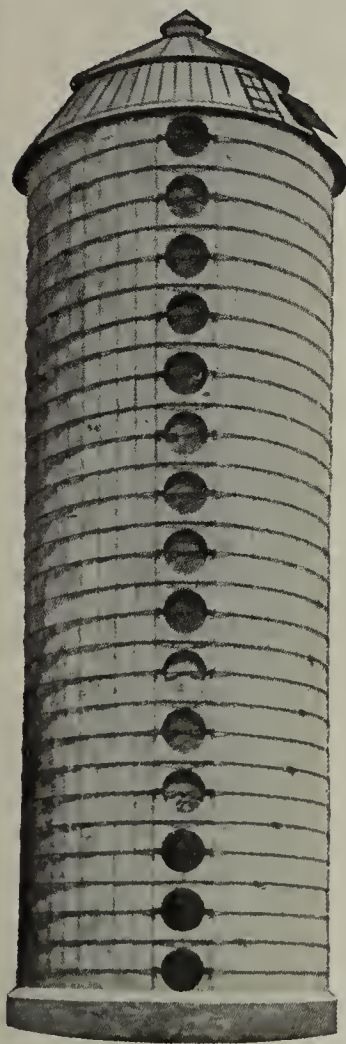
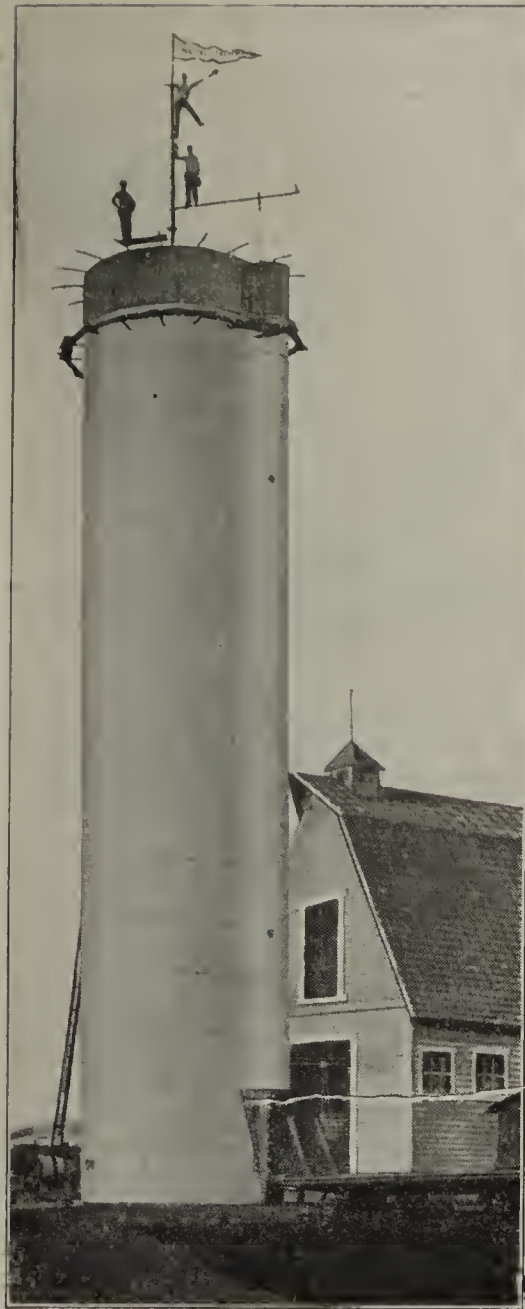
175 West Jackson Boulevard

CHICAGO

Polk Genung Polk Company

FORT BRANCH

INDIANA



YOU will recognize this Cement Stave Silo is built with Pierce Round Steel Doors. These doors are rapidly eliminating wood doors, also spreaders which frame the opening in an ungainly, awkward manner.

ABSOLUTELY FIRE-PROOF.

Simple, effective arrangement provided to fasten rod at door frame.

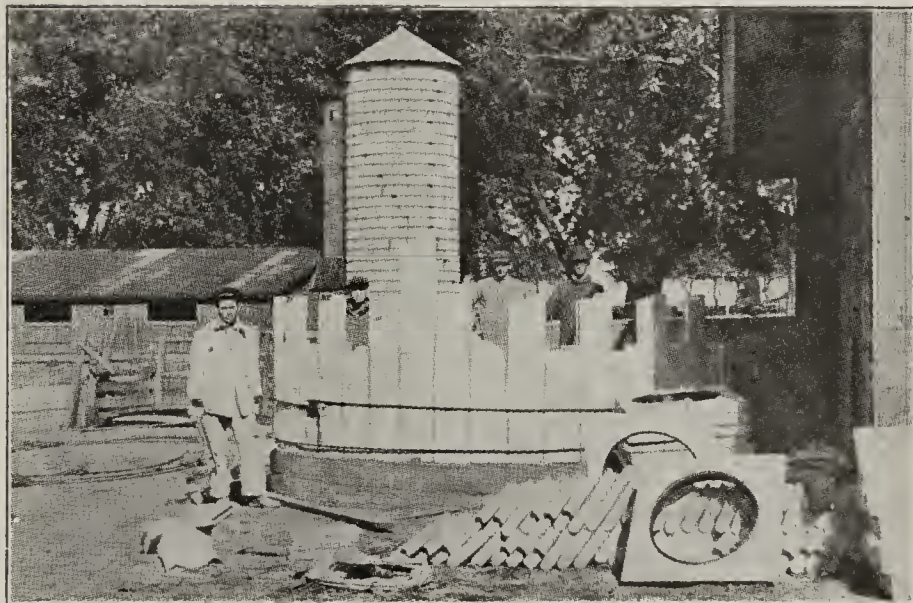
WRITE FOR DETAILS AND PRICES. It is never too late to improve your silo. No extra equipment required than you are using.

Ask for literature and prices on galvanized roofs, chutes and ladder.

We are largest distributors of silo rods and lugs in the United States.

All inquiries given prompt attention.

THE PIERCE COMPANY
KANSAS CITY, MO.



HERE'S a chance to get into the silo business and to keep the profits where they belong—in your own pocket.

You can start into this business without a great expense if you select the right system. We can start you on the "right system."

Buy a set of Caldwell molds and make Silo Staves as you make building blocks. No royalty to pay. No territory to buy. We sell the outfit without strings attached to it. This is a good proposition and it will mean money to you.

Caldwell Stave Silos are permanent because each unit is made of poured, reinforced concrete, each unit interlocks with the six adjoining staves and each unit is crossed by three steel bands, resulting in a storm-proof, water-proof, air-proof, acid-proof, fire-proof silo that you can sell.

The most businesslike silo proposition on the market will be sent free on request. Write today for an outline of our system.

Co-operative Concrete Construction Co.

OSKALOOSA, IOWA

EXT. DEPT.

A Model Concrete Products Plant

The new modern plant of the Ray County Concrete Company of Richmond, Missouri, was recently visited by the writer who found it a busy looking place and the improved machinery was running smoothly and at a lively clip, pulled by a 7-horse power engine.

The Dunn cement drain tile machine is wonderfully complete, and 129 pieces of concrete tiling was being molded by it every hour. This tiling is so useful on the farm that it is being sold as rapidly as it is manufactured.

A car load of Joplin grit and another car of Kaw River sand was stored away, and more coming. There were also over 1,000 sacks of cement ready for use, everything loaded and unloaded on a miniature railroad that runs through the premises.

There were large quantities of concrete blocks for culverts, bridges, etc. A sand-sifter was running overtime and two men can not feed it fast enough to "choke" it. Mr. Frank Creason, manager, invented it.

There were a number of concrete burial vaults completed, remarkable for the durability and the low price at which they can be sold. The molds for making the vaults were made by the Automatic Sealing Vault Co., 216 East River street, Peru, Ind. Fence posts that will last till Gabriel comes were to be seen all around. Dunn fence post molds are being used. Monuments were standing erect as samples to show at what reasonable figures mounds of earth can be adorned after the corrupt has put on incorruptible and the mortal immortality. They are beauties.

Two Dunn concrete mixers were going some and the entire plant looks good—it is one of the most important industries in Ray county and will continue to grow. The concrete troughs completed are quite an improvement on the ones some of us have seen of the "home manufacture" brand, one-half of a log hewn out. What fine things small ones would be to catch sugar water in.

Farm drain tile from 3, 4, 5, 6 inch and larger was piled up and all around. The 12 inch bell sewer tile was also there in abundance.

The building blocks and the bricks are beauties and something is put in them to make them glisten like diamonds, or dew drops in the sun, like icicles on the trees and shrubbery in wet and zero weather.

The sparkling concrete flower vases are going to prove exceedingly popular. They sit upon pedestals very majestically and one is going to be tendered to the county court for the court house yard, in which flowers will be safe from the reach of dogs, which sometimes make "Dog Town" out of the square and yard. It's a guess that everybody who has a yard and loves flowers will want one of those beautiful vases.

Mr. W. A. Mullin and Mr. Frank Creason look after everything personally, and they are building up a big business, deserving the splendid patronage and encouragement they are receiving.

The molds for making the ornamental concrete work and concrete blocks were furnished by the W. E. Dunn Mfg. Co., 414 Twenty-fourth street, Holland, Mich.

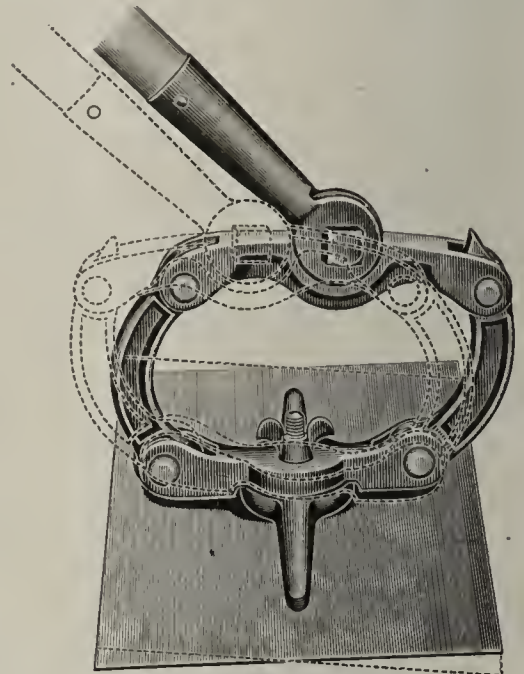
Long Handle Cement Finishing Tools

The cut shown herewith is the double action device that places Abram tools far in the lead. As the trowel is pushed, the forward edge of the blade is tilted slightly. As the trowel is pulled, this action is reversed and the rear edge of the blade is raised. No need to raise, lower or twist the handle. The trowel blade is tilted exactly the same at all times. This insures a smooth, even and uniform job. With an hour's practice an inexperienced man can do a first-class job of finishing.

Abram tools, manufactured by the Abram Cement Tool Co., McNair Bldg., Detroit, Mich., save four-fifths of your labor bill for surface finishing. It takes five men doing it the old way to equal one man using Abram long handled tools. Below are a few testimonials from satisfied users:

Madisonville, Ky., Aug. 7, 1916.

Sirs: Please send at once, as I am in need of one No. 2 Jointer. Tools are doing good work. They won a foremanship for me. Am doing the nicest finishing in the



The Abram "Successful" Long Handle Cement Finishing Tool.

town and getting lots of compliments. I lay it all to my tools, if I did have, to buy them myself.

Yours for business and success,

LEE U. HAWKINS,

Ebenezer St., Madisonville, Ky.

Madisonville, Ky., May 19, 1916.

Dear Sirs: Been using tools some time now and can say they are O. K. in every respect. Our City Engineer endorsed them. I would like to see more of them in use. I am the only finisher in this county that furnishes his own tools. I buy my own tools and have what I want.

Yours for business,

LEE U. HAWKINS,

Madisonville, Ky.

Lansing, Mich., June 21, 1916.

Gentlemen: I am sending you check for \$24.84 to pay for sidewalk tools sold to Dept. of Public Works.

Our sidewalk foreman is much pleased with them; says they are the best he ever used.

Please acknowledge receipt of payment.

Very truly yours,

W. C. HILL,

Supt. Public Works.

R. L. Slocum, Assistant Superintendent Universal Cement Plant

The Universal Portland Cement Company announces the succession of R. L. Slocum to the position of assistant superintendent of Mill No. 5 at Universal, Pa., made vacant by the death of R. F. Knoth in January of this year.

Mr. Slocum was born at Homestead, Pa., graduated from the Pennsylvania state college in 1905, spent two years in construction for the Homestead Steel Works and began work in the spring of 1907 for the Universal Portland Cement Company, in charge of building construction and installation of machinery at Universal, Pa. Since the completion of the plant he has been responsible for extensions, repairs and in part for operation. His title is the same as that held since 1911 but he is now in charge of plant operation and management under E. D. Barry, superintendent.

The Roof for All Time

Start a
"Concretile"
Plant



The Greatest
Opportunity in the
Construction Field

The most economical, attractive, permanent fireproof roofing in existence. A standard roofing in Germany for more than 25 years.

The manufacture of Walter Concretile is now a national industry in this country. Within the last eighteen months large plants have been established in many of the leading cities. All operating plants have business booked ahead—the demand is universal.

We Do Not Sell Blue Sky

We sell complete equipment for starting business. We protect you in the territory by establishing only one plant in a locality.

Send today for free booklet giving full information.

Walter Concrete Machinery Company

418 Saks Building

State Representatives Wanted

Indianapolis, Ind., U. S. A.

The Multiplex Double Stripper Block Machine makes two Hollow Plain or Rock Faced Block of Wet Mixture at ONE OPERATION



Here is a machine that cuts down the cost of making your building block. In making plain faced block the machine handles a wet mixture and stripping the block out it trowels the sides. The wet mixture compacted under pressure from *both top and bottom*, produces a strong waterproof block which is easily cured. A 150-lb. man on the end of the lever will exert a 40-ton pressure on the block. Two men will make from 700 to 800 blocks per day on this machine.

Write for our latest printed matter explaining the operation of this labor-saving machine in detail

Write for catalog No. 10 and mention Cement News
The Multiplex Concrete Machinery Co., Elmore, Ohio

Same Machine Makes Chimney Block

The Multiplex Stripper may be equipped for manufacturing chimney block as well as building block. Note the flue block shown here with the round smoke chamber in the center, the ventilating chambers in the corners and the tongue and groove joints insuring rigid construction. There is money in the manufacture of chimney blocks alone.



Boiling Hot Caustic Soda and Cement Mixture Stops Leaks in Concrete

By H. W. Streuli, Schenectady, N. Y.

Leaks in concrete can be stopped in the face of running water, even when this is under some pressure, by enlarging the break and properly applying a hot mixture of cement and caustic soda, which sets almost instantly.

Leaks of this kind frequently occur even in the most careful work. Sometimes they result from small defects in the joints between one day's concreting and the next, where a small area has not been perfectly cleaned, or where a low spot in the old concrete retains water used to wash the surface and forms a "honeycomb." Leaks are sometimes produced through no fault of the contractor where the concrete has been placed under extreme temperature conditions without sufficient provision in the way of expansion joints. Slight unequal settlement or shrinkage may also produce leaks.

When leaks develop it is generally too late in any case to remedy the cause, and the only thing left to do is to stop them, sometimes at the expense of considerable money to the contractor and worry to the engineer.

This is often done by piping the flow to one point, grouting in the pipe while it is passing the water, cutting the pipe off within the surface of the concrete and capping it, after which the hole left over the pipe is plastered up. This is a slow, expensive and puttering way of doing the job. Frequently the pipe rusts, discoloring the concrete and sometimes reopening the leak. There is always danger of this if the pipe is exposed to electrolytic action. Leaks may also be calked before plastering with jute, or with lead wool and wood wedges. Jute will only do for small leaks without much pressure, and many engineers do not approve of the use of wood left permanently in the concrete.

To overcome these objections, the method referred to was developed by the writer in connection with other construction superintendents and engineers on sections of the Catskill Aqueduct and Passaic Valley sewer, where leaks which occurred months after the completion of portions of the work caused considerable trouble. The section of concrete around the leak is cut out to a depth of 3 or 4 inches with a chisel so that the hole is larger at the base than at the surface. A small quantity of fresh Portland cement is then mixed with a boiling-hot solution of caustic soda into a thick paste, which is applied rapidly with the hands (which should be covered with rubber gloves) to one side of the cavity. The plaster is pressed firmly against the old concrete and held for a minute or more. In this length of time it sets very hard and can only be removed with a chisel. This operation is repeated, following around the sides of the cavity, until a small opening remains, through which the water is now flowing. This small opening is again shaped with a chisel till the bottom is larger than the opening at the surface. Enough freshly mixed paste is then taken in the hand completely to fill this opening, and applied suddenly with one hand, holding the paste in place for a few minutes. If the work has been done well, the leak will be completely closed.

Of course, practice is required for the successful use of this method, and there are several important points to be carefully observed. The soda must be of the best quality and fresh, very concentrated and mixed with very little water. The mixture must be boiling hot when the cement is added, and the latter must also be perfectly fresh. Very little of the paste should be prepared at one time, as it hardens almost instantly. Just

enough of the soda solution should be used to make a stiff paste, which should be mixed very rapidly by kneading it with the hands. The rubber gloves are essential, and anyone attempting to handle the paste without them will certainly regret it.

A New Derrick Excavator

There are only two machines that will dig material that is met with, and they are the steam shovel and the dipper dredge. By using the Bishop Patent Excavator, any derrick having a rectangular or a square boom can be converted into a steam shovel or a dipper dredge made out of a derrick boat.

This apparatus can dig anything a steam shovel will dig, and its range is from the base of the derrick to the end of the boom and below the base of the derrick the length of the dipper arm.



Why keep an expensive steam shovel at work excavating dirt, sand, stone, etc., when lower-cost equipment will do the same work? With your regular derrick you can dig material from the bank, you can excavate earth, you can handle loose materials on the construction job.

The Bishop Patent Derrick Excavator is an attachment that is readily adjusted on your derrick. It consists of a carriage traveling on the boom, a dipper and a dipper arm. A square or rectangular derrick boom, a double-drum engine and swinging gear are required. One man operates the equipment.

Cement and Engineering News, 672 Transportation Bldg., Chicago, will gladly send you catalogs, prices and further information.

Device Collects Flying Gypsum

A simple device which is attached to the windows of the gypsum plant at Port Clinton, Ohio, has been patented by Francis J. Griswold, vice-president and general manager of the American Gypsum Company. The apparatus sucks the fine particles of gypsum out of the air into a receptacle on the principle of certain makes of vacuum cleaners.

Mr. Griswold's invention will, it is predicted, find wide use as it accomplishes two objects; to purify the air for the workers in the plant and to save the finest product of gypsum, the fine particles which go to make up the best grade of plaster of Paris.

The process of manufacturing gypsum products in the Port Clinton plant, said to be the largest of its kind in the world, is so carried on that much of the fine dust rises into the air, making it almost impossible to work until the dust is allowed to settle. Mr. Griswold's invention is calculated to obviate such delays.

Many Installations of Clark Dust Constructing Apparatus

The Clark Dust Collecting Company, Fisher building, Chicago, are enjoying a prosperous business. They write as follows:

We have sold the Southwestern Portland Cement Company, El Paso, Texas, three of our American Suction Filters; one for the Raw Grinding Department, one for their new Crushing Department, and one for their Coal Grinding Department.

We have also sold two American Suction Filters to the same company for their Victorville, Cal., works; one for the Packing Department and one for the cement grinding department.

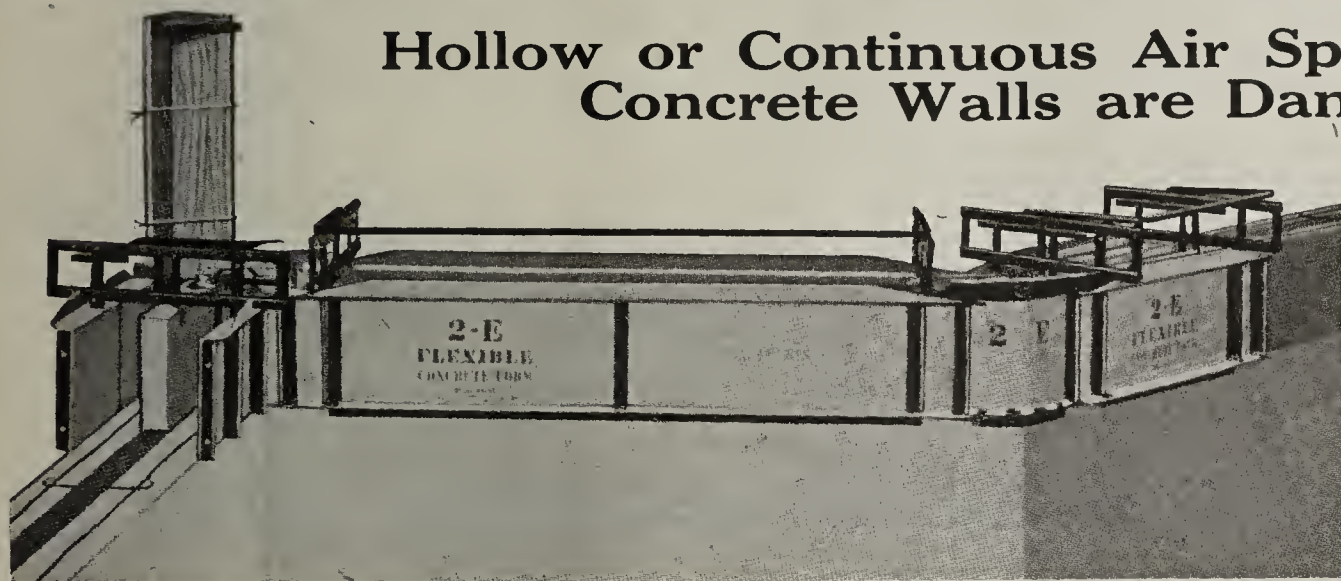
We also sold our Metal Centrifugal Separator for the El Paso cement plant on Coal Dryer, and also

sold the same concern four of our Metal Centrifugal Separators for their Packing Department.

Recent sales have also been made to the Marquette Portland Cement Company, Chicago Portland Cement Company and Universal Portland Cement Company.

Ideal Concrete Block Machines

Ideal Concrete Machinery Co., 1353 Monmouth Avenue, Cincinnati, Ohio, points out that the rapid increase in the demand for "permanent," fireproof construction at popular prices has created a big market for dependable concrete blocks, and that the latter may be made on Ideal concrete block machines. The parts being interchangeable and use being made of face-down plates, enables the contractor to turn out a wide range of blocks in many sizes and shapes as well as with varied surface treatment.



Hollow or Continuous Air Space Monolithic Concrete Walls are Damp Proof

2-E Equipment

makes possible the construction of concrete homes that are absolutely fire and damp-proof, at a cost not to exceed wood construction.

Send for our free trial offer.

2-E Flexible Concrete Forms

692 Centre St., EAGLE, WISCONSIN



The Rugged Ruggles AERIAL CARRIER

Suspended over Slate Quarry

SELF DUMP BRAKE LOCK ING

Built in Two Sizes:—1 to 5 tons capacity, 5 to 10 tons capacity.

The **Rugged Ruggles** is made for special use on cement and gravel construction work. For all kinds of quarries where the waste is taken from the pit and dumped at the surface. It will take any load up to ten tons, from any depth to the cable, where it is automatically released and sent either up or down the cable and dumped in mid-air or lowered. One man can operate three **Rugged Ruggles** on as many cables with a three-drum engine:

No brake to wear the cable—Can run on a flat cable.

Simple in construction; made entirely of steel; all the sheaves steel bushed or brass, and is backed by years of extensive use.

Manufactured by

Ruggles Machine Co., POULTNEY VERMONT Dept. C

Bulldog Construction Throughout

Digs on both sides and better than any bucket of the same weight

Our aim is to build a better bucket, knowing that in the long run, everything else being equal, the user will try the bucket that stands up.



It Speaks for Itself
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Stucco Residence of Mr. G. T. Burrell, at River Forest, Ill. Stucco on nine years. The stucco on this residence was made by the Garden City Sand Co. of Chicago. Their guaranteed "Stonekote" stucco is a plastic Portland cement for Rough Cast and Float Surfaces. It is as hard as natural stone and is made in any non-fading color desired. "Stonekote" is shipped as a dry material; any mechanic can mix and apply it.

Artistic Stucco

A Paper Read Before the American Concrete Institute

BY JOHN B. ORR,

Contractor, Miami, Florida.

Stucco is among the oldest of man's early attempts at the artistic. With all its possibilities, and despite the fact that there can be found to this day portions of stucco in a good state of preservation after standing the wear of many centuries, there is no other form of building material that has fallen more into disrepute. This is especially so in the United States.

The causes can be traced largely to the slipshod methods of procedure that have gradually crept into our building industry. Today the main consideration is whether a contractor can complete in sixty days what should take three or four times as long. Short cuts are taken wherever possible; things that appear small in the successful completion of the work are sacrificed for time. The boy learning the business does not learn how well to do his work, but how fast to do it.

Some contractors govern their cost by these methods and we get results so often noticeable in modern construction, competition in price instead of competition

in value or good work. The good contractor who tries to figure at a price that will permit good work in many cases is forced out of business, leaving the field open to the cheaper man and cheaper methods.

The old school of craftsmen had a different view; they tried to make their work masterpieces—just as much so as the artist did his on canvas.

We find that stucco was used in building almost as soon as buildings were found to be necessary. It grew from the crude mud huts to the artistic treatment of exteriors to be found in the old world today. Stucco is an Italian term usually applied in Italy to an exterior plastering, although we can trace it further back under a different name. The old Egyptians and the classical Greeks used a form of exterior plastering extensively; however. I have always looked upon Italy as the mother of the plastic art and responsible to a great extent for the artistic effects of exterior plastering generally known in this country as stucco. In Great

Britain stucco is a somewhat indefinite term for various plastic mixtures.

The early workers in stucco had each their different formulas for treating the stucco to make it weather-proof. Pliny mentions fig juice as being used in exterior plaster; elm bark and hot barley water was mixed with the stucco used on Justinian's church of the Baptist, Constantinople. Bullock's blood was employed for this purpose in the mortar for Rochester Cathedral, England. White of eggs and strong mort of malt was used in the lime for Queen Eleanor's Cross, Charring Cross, London, in the year 1300. It is an historic fact that, during the building of the Duke of Devonshire's house at Chiswick, the exterior of which was plastered with stucco, the surrounding district was impoverished for eggs and buttermilk to mix with the stucco. My mention of these different methods and mixtures and treatments is to show the care and wide range

had good results in some cases and in some others check cracks did appear despite the fact that I had made every effort to avoid them. I never yet had any to scale or fall off. My next attempt was to use an over wash of liquid stucco. This last method has proven very satisfactory and I have jobs that are two years old and on which there has been no appearance of crazing.

In Florida we have several obstacles to overcome, although we do not have the freezing weather. We get a very poor sand that is impregnated to a certain extent with salt. The sand is not sharp enough. We have quick-drying weather and strong sun heat, and I believe this to have been severe enough test to show that the stuff would not craze.

To the architect and designer, as a layman, I offer a few suggestions and criticisms. As a general rule they do not give enough study to the possibilities in color



A Cement Stucco House at Brookline, Mass.

of methods and mixtures that were used in the endeavor to make the stucco weatherproof, and the difficulty that the old craftsman had to contend with in getting these results. Modern manufacture has overcome this to a large extent and has made the path of the stucco workers easier.

It is a curious fact that the fountain of possibilities in modern stucco has hardly been tapped. I give for the reasons, first, fear of the permanency of the material; second, neglect by the architects in not studying its possibilities; third, the difficulties in getting the work executed owing to the ignorance of the craftsman in this branch of the plastic art.

In reply to the first, anyone who has traveled or has gone into stucco historically can prove the permanency of the material before and after the introduction of Portland cement as the material. By the introduction of Portland cement and waterproofing compounds much has been done to simplify and make permanent the mixture. The danger in most cases to be overcome is the manipulation of same.

My greatest obstacle has been crazing or check cracking. This I have cured by what I believe to be the only sure method. The richer you get the mix, the more danger there is in check cracking; rapid drying, heat in cement, soft sand; these all help to cause check cracks. I have taken precautions against these dangers and have done what I could with the local materials. I

effects such as are to be seen in Europe, Cuba and other Latin countries. Then, in ornamentation they seem to forget that they are working in a very plastic material that lends itself to the fullest extent in obtaining lights and shadows. I believe that to get the full effects, relief work in stucco should have the appearance of being remodeled in place with this material. It should not have hard lines and in no case should it have the appearance of carving in stone. The work should retain all the touches of the modeling, those touches that give the sketchy effect which is lost in carving in stone. In preparing the models the modeler should accentuate the detail and not attempt to smooth up the model. These markings, when brought out, all serve to make the work plastic and alive. It also helps in obtaining light and shade when colors are used as the finish. Even when the work is colored integrally, these markings of the tool all stand out and bring out the work better to the eye when the buildings weather; in other words, the workman should not attempt to get in the clay any smoother work than he could get if he was modeling with stucco right in place instead of modeling in clay.

By proper manipulation of colors and attention to the above details, great beauty can be obtained from work in low relief. On several jobs which I have under way I am using this method and am getting what I consider good results. I am not attempting to confine

the relief work to panels, but am using the walls as the background, getting an effect as if the work was actually modeled in stucco, and keeping the relief work very low and plastic. These are the touches that give the sketchy effect that is lost in the carving of stone. As a general rule it seems to be the practice of designers in stucco to copy stone, which, in my opinion, is entirely wrong. Stucco is a distinctive material and should be used as such. In my ornamental molding and relief work I use a combination of several colors (which match with the general color scheme of the exterior of the house) to bring out the effect and give light and shade. I use the darker tints in the background and work out the lighter tints to the highlights, blending all the tints by rubbing the one color into the other. By doing this it is possible to bring out all the plastic beauty of the modeling and give an artistic appearance to the whole scheme. My colors on stucco I bring out by the use of a wash of liquid stucco. I am quite enthusiastic on this color work and I think it wonderful the effects that can be obtained with its intelligent use.

A study in colors for the stucco of buildings is the work of an artist and should be given such care, with due consideration to the surroundings in which the house is to be built. I possibly might be treading on the toes of manufacturers of cement paints when I say that I use this method only when actually called for in some public buildings where the effect is to get something that will always look new and clean. In some cases, of course, this is very necessary; but for residential work we cannot do better than try to copy the early Italian stucco effect, that is, to get the results like stucco and not paint. There is something about the technical paints that give to the stucco an artificial appearance.

I never like to see a residence looking as if it had come out of a machine made mold. I like to see the sketchy effect, and also like to see the building weather properly—not staying one solid color, but getting the soft effect that only a stucco can take on; a blend of several shades which comes by age.

My idea in getting effect and tone to a residence is that a study of the whole scheme, including the landscape work, should be taken into consideration and let

the residence become a part of the landscape on which it sits and not make it look like an obstacle that has been put in the way of the beauty of nature. In public buildings there is a big field for the stucco worker in producing the effects such as obtained by the use of terra cotta. Stucco can be made a formidable competitor of this material. It can be made permanent and has as wide a range of colors as polychrome terra cotta. When this is the result that is required I use cement paints as a background applied over stucco surface for the color effect. I apply the stucco according to the methods and specifications given later. When the stucco is thoroughly dry, I then apply a priming coat of a good cement paint, using the material thin and working it into the stucco surface with the brush, being careful not to use the material too thick so that it will not spoil the "grain" of the surface, the texture of which should be a smooth sand finish. If the effect wanted is a blend of several colors my system is to cover the surface of the stucco with two coats of cement paint as mentioned above. I then mix up my blending materials in the form of a stain, using good mineral colors ground in oil which I thin down with prepared oil. I apply this stain over my relief and ornamental work in the various tints desired. I then rub off the high lights and, in general, blend in the colors to give it the soft effects. On the plain surfaces I apply the stain in the color desired, then rub off as much as possible; this gives a very pleasing mottled effect that blends in with the under coating of cement paint and takes away the hard appearance. I have just completed a building in which I used on my relief work, blue, golden buff and cream, and got a beautiful effect that resembles old bisque china. On some of my work I get these effects by coloring integrally and rubbing over with an oil preparation.

On residence work my methods are entirely different. I apply the stucco as specified, getting the texture desired, preferably a medium rough cast. In some cases I color the work integrally, a liquid form of the stucco of the same colors with a binder and hardener and waterproofing added. This material, when properly applied over a fairly rough texture, makes a fine finish and when one gets familiar with the working of it, fine color effects are obtained. This liquid stucco is applied



Cement Stucco Residence of Mr. T. A. Morel, West Medford, Mass.
Designed by Architect John J. Smith, Boston, Mass.

Cement Stucco Houses

A successful method for the construction of stucco dwellings is that adopted in the building of the house illustrated on this page. This construction has been followed for the past decade along the eastern coast of Massachusetts, where the climatic conditions are a severe test of any building.

The frame of the house is of wood, erected in the usual manner for a frame building which is to be finished on the exterior with clapboards. Expanded metal lath is nailed directly to the outside of the studding. Portland cement stucco is then applied to both sides of the lath, making a reinforced concrete slab two inches thick, with the lath in the center of the slab.

The studding have the outer edges encased in the concrete, and this projection of the slab provides all of the lateral bracing necessary to stand the severe winds of that section. The exterior is finished with any of the usual methods employed in finishing stucco. The result is a strong and substantial house that requires no outlay for painting or repairs.

with a brush, as paint. The stucco surface, when finished, does not look like paint but retains the softness of the stucco with an unlimited range of color effects. On the ornaments and trim I use color effects with this wash in very much the same method as I specify for my treatment on public buildings except that the material is a stucco composition. To get the shading, great care and taste must be used. This liquid stucco coat should be applied before the stucco surface is dry; usually, wherever possible, a day after the stucco is finished. It then dries and sets along with the stucco and makes a good bond. Spraying with water helps to make the surface bind, using a very fine spray. It gets harder with age and being of practically the same composition as stucco it retains all the soft tints and makes a house very attractive, especially when it has good surroundings. It seems to catch all the shadows and to change with different positions of the sun, reflecting the color of the surrounding foliage. It is this soft color effect that has made the homes of Italy and the south of France the mecca of the students of art.

The specifications which I give are taken from an article I wrote some time ago and cover practically all conditions and treatments except possibly the texture for obtaining the Italian effects. The stucco in this case should not be perfectly straight except in the molding and trim. The molding and trim should be treated as specified, the plain surfaces to give the appearance as if the stucco were applied over cobblestone. No straight edges should be used. The surface should be worked up to a condition with easy modulations. After it is partially set, go over it with the edge of a trowel to slight the roughened surface, being careful not to leave trowel marks. Apply over this the liquid stucco with the desired tints.

I have another style of finish which gives a splendid effect and which is very popular here. I bring up the work to the straightening coat as specified. For the finish I apply over this surface a very thin coat of cement and sand troweled with a good pressure; I then dash with a whisk broom, being careful not to throw the whole contents of the broom in one place but to spread it and get it with the texture about the size of peas, uniform over the surface. I then apply over this the liquid stucco coating.

Specifications for Stucco on Concrete Work

Preparation of Surface—The entire surface to be examined and all loose form scale removed from the surface. The entire surface to be gone over with a hand pick or an axe to roughen the surface; if brick, rake out joints. This is for the purpose of forming key for stucco. The surface to be brushed clean and thoroughly soaked, ready for application of stucco.

Proportions: Straightening Coat—The proportions of this coat shall consist of 4 parts of Portland cement of approved brand to 12 parts of sand and 2 parts of hydrated lime. The above material to be thoroughly mixed dry, then temper the mortar with water, to which has been added 1 part of concentrated waterproofing paste to every 25 parts of water.

Finish Coat—The proportions of this coat shall consist of 5 parts of Portland cement to 12 parts of sand and 15 per cent of hydrated lime. (If white color is desired, use Medusa white cement and local white sand.) The above materials to be well mixed dry, then temper the mortar with water to which has been added 1 part of Concentrated Waterproofing Paste to every 18 parts of water.

Application of Stucco: Straightening Coat—Care has to be taken that the surface is thoroughly saturated with water to insure perfect bond, then apply straightening coat. Bring the surface to a true and straight

condition, using a traversing rod (no darby float to be used on first coat), then scratch the surface with a wire or nail scratch.

Application of Finish Coat for Smooth Surface—If stipple, use same process, only stipple before set. If rough cast, dash the finish material with a broom. Thoroughly saturate the first coat surface with water until it presents a glaze appearance. When this glaze disappears, which will be in a few minutes, apply the finish mortar, which should not be too soft, and bring the surface to a true condition with darby float. When the mortar will permit, go over the surface with hand float, bringing to a true finish free of cat-faces or voids; the entire surface to be gone over with burlap or hand float and patted to take out float marks. No joints to be allowed in the work where they can be seen. The entire surface to present a uniform appearance in color and texture. Mortar should be applied as quickly as possible and at all times protected from the sun.

Protection—Special care should be taken to avoid too rapid drying; if in the direct rays of the sun, it shall be protected with burlap or wet canvas, and when sufficiently resistive, should be sprinkled with water for at least six days.

Stucco on Metal Lath—If stucco on metal lath, specify three-coat work with good fibre in first and second coats, waterproof in second and third coats.

Forming Molding—Cores for molding shall be formed of concrete by concrete contractor, allowing about 1 inch for finish. All molding to be run and finished with hand float to give same texture as rest of surface and to help bind the surface. When a condition arises where a heavy coat of mortar is necessary, a key for the mortar shall be formed by driving galvanized nails into the core.

Having thus given specifications for stucco work, it would be well to go over them for the benefit of the craftsman desiring to follow this method of procedure.

The cement, sand, etc., should be well mixed in its dry state and then tempered with water, to which the required amount of waterproofing material has been added. Following this the mixture should be worked to a good plastic condition. In making application, good pressure should be used in order to insure a good bond. In applying the straightening coat, do not use the darby float, because the working of this tool is liable to drag the material and interfere with the bond. Rather use the straight edge. Use the rod with an up-and-down slanting motion to cut off the excessive material and leave a rough surface, then scratch with a wire, being careful to scratch before the work is too hard.

After the straightening coat has been applied, the molded and ornamental members should then be worked out. It is common practice with many plasterers to add plaster of Paris or some of the patent hard wall gypsum plasters to the material used for ornamental and run work. This is for the purpose of making the material set quickly, but is a wrong policy and should be avoided. The mechanic who has pride in the execution of his work will not adopt these methods if he knows that bad results will follow by his so doing. Plaster of Paris and patent hard wall plaster are diametrically the opposite to Portland cement. The result is easy to foresee. The work blisters, scales and falls off, the set of the cement is killed, and the material becomes like powder.

The reason that some mechanics use these methods is to gain speed in finishing the work. If, however, the molding and projections are worked together with a little system it will be found that finished results can be obtained with very little more time than through the use of foreign materials. All the moldings and

other run work should have running strips set so that the craftsman can build up the various moldings gradually by giving each one as big a coat as will hang, doing the same to the others, and so on. By the time he has gotten to the last piece, he will find the first piece is ready to receive another coat. The running molds should be muffled, allowing about $\frac{1}{8}$ -inch for finish. After the moldings and run work are brought out to a complete finish, they should be gone over with floats, so as to insure the surface having the same texture as the rest of the wall.

In applying the finish coat, all splashes and pieces of projecting cement should be scraped off the straightening surface. The whole surface should then be saturated with clean water, and it is at this point that the waterproofing plays such an important part. If the undercoat is waterproofed, it will hold the moisture of the finish coat and will allow the cement its own time to set. The ultimate adhesion, also the uniform working and strength of the finish coat, depends on this. If the moisture, or "blood" of the cement is absorbed by the suction of the undercoat, the cement will become inert and will crack, peel, or scale.

In working the finish coat, bring it to a true, straight surface by use of a straight edge and darby float. This material should not be mixed too soft. A good method is to have one set of plasterers lay on the material and then have another set follow with rod and darby, working it carefully in all directions until it is brought to a full and straight surface. After the moisture has disappeared from the surface, gently scout it with a good cross-grain wood float. Care must be taken if dry spots should develop in floating not to throw water on the wall, but to dampen the float until the desired moisture is showing. Never stop the cement where the joint can be seen. Make all joinings at moldings or projections.

Next after floating, the object is to be rid of the float marks. This is done by gently patting the surface with a float or by using a pad made of burlap. If the finish is accomplished by this method, good results will always be obtained.

When the work is in the direct rays of the sun, it should be protected with burlap or oil duck cloth hung up in the form of a shade. When the work is sufficiently resistive, it should be kept moist for at least six days.

Method of Estimating the Cost of Operating a Motor Truck

Many contractors are now using motor trucks for their hauling, while others are considering their use. It is well, therefore, to be able to estimate the cost of operating the trucks and also the cost of hauling on such a basis that the items will apply to new jobs when estimating on them.

First comes the fixed charges that can be figured as a daily charge against the truck. The other costs can be estimated under operating expenses and be figured on a mile basis. The best unit for figuring hauling costs is the ton-mile.

The example selected is the cost of operating a five-ton Pierce-Arrow motor truck, the first cost of which, complete with dumping body, is \$5,000. The figures follow:

FIXED CHARGES

Interest on Investment, 6%	\$ 300.00
Insurance:	
Fire at $1\frac{1}{2}\%$	75.00
Property damage (\$1,000)	30.00
Collision 2 $\frac{2}{5}\%$ (\$25 deductible)	120.00
Liability	75.00

Garage at \$10 per month	120.00
Driver at \$18 per week	936.00

Fixed charges per year	\$1,656.00
Fixed charges per day (1/300)	5.52

OPERATING CHARGES

	Per Mile
Tires (7,000 miles guaranteed for \$309.70)	\$0.0442
Gasoline $4\frac{1}{2}$ miles per gal. at 20c per gal.	.0444
Motor oil, 250 miles per gal. at 60c per gal.	.0024
Lubrication allowance	.0013
Repairs and maintenance (overhauled, 15,000 miles at \$500)	.0333
Depreciation at 150,000 miles, deducting tires	.0387

Operating cost	\$0.1543
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The fixed charges are readily understood, as they cover the interest on the investment and the various kinds of insurance, except that against theft of the vehicle. The charges for garage and the driver of the truck may vary somewhat from those given, but due allowance can be made for such variation.

The total yearly charge is divided by 300 to obtain the daily charge. For some classes of hauling this may be about right, but for contractors more than 65 days would be lost in a year. Few contractors could figure more than 250 days and in the far North or on certain classes of work not even that number could be counted upon.

To reduce the number of working days will naturally increase the daily charge.

Under the operating charges the tires are figured only for their guaranteed life, so that any additional mileage would mean that much gain. The price of gasoline and oil will vary in different sections of the country.

The repairs and maintenance are figured on a basis of overhauling the truck every 15,000 miles, while the life of the truck is figured for 150,000 miles, this meaning, for an average of 50 miles daily, a ten-year period.

The total cost of operating for different miles traveled in a day is as follows:

30 mi.	40 mi.	50 mi.	60 mi.	72 mi.
\$ 5.52	\$ 5.52	\$ 5.52	\$ 5.52	\$ 5.52
4.63	6.17	7.72	9.26	11.10
\$10.15	\$11.69	\$13.24	\$14.78	\$16.62

With an average load of five tons, half of the mileage being with the load and half without, we have for these five examples:

Ton miles	75	100	125	150	180
Miles	30	40	50	60	72
Total cost	\$10.45	\$11.69	\$13.24	\$14.78	\$16.62
Cost mile	0.338	0.292	0.264	0.246	0.23
Cost ton mile	0.135	0.117	0.166	0.098	0.92

Most five-ton trucks will stand an overloading of from one-half to one ton, so that any extra load means further reduction of costs.

Poured Sewer Pipe Molds

No tamping required in manufacturing sewer pipe in Dunn's mold, shown herewith. Mix the concrete wet and pour it into the molds. The result is a firm, dense pipe that will stand the severest tests, which is very important when the pipes are to be used for sewers, irrigation and road culverts.

In case you wish to make dry tamped pipe, you can do so. The stability of the core form and the positive locking device insures a product of uniform thickness. Send for catalog fully describing these molds and the poured system. Write the W. E. Dunn Mfg. Co., 414 Twenty-fourth street, Holland, Mich.

CEMENT AND ENGINEERING NEWS

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Advertising Rates Sent on Application

JOHN F. WALDRON

Advertising Manager

CHICAGO, MAY, 1917

Durability of Concrete Drain Tile

The Michigan Agricultural College of East Lansing, Mich., will gladly send any of our readers a copy of their special bulletin, No. 75, free of charge, entitled "Durability of Concrete Drain Tile."

The extensive use of concrete in manufacturing drain tile is a somewhat modern development, yet there are in existence today concrete tile drains which were laid twenty-five or more years ago and which, so far as the concrete tile itself is concerned, have given eminent satisfaction. Within recent years the manufacture of concrete tile has developed into an industry of considerable magnitude. In fact, the strides made during the past few years have been very rapid. But the tile produced by some manufacturers, varies greatly in quality, and the manufacturers as well as the users are ignorant as to the causes of both success and failure in making tile of good quality. This situation has led to a number of investigations, carefully conducted by research workers, in the effort to distinguish between good and poor tile and to discover the causes of success as well as of failure in the production of tile of good quality.

As numerous requests for information in regard to these points have come to the College Experiment Station, an investigation was undertaken to determine, if possible, the direct causes of disintegration of concrete tile in Michigan soils. The conclusions of this investigation are not final but the findings, so far reached, indicate that concrete tile can be depended upon when made according to certain processes which have been fairly well established as governing success.

Whenever the disintegration of tile has been noted in our experiments, writes Mr. O. B. Winter of the Michigan Agricultural College, it has been found to be due to one or more of the following causes:

- (1) the use of too lean a mixture,
- (2) the use of too dry a mixture.
- (3) improper hardening of the product after it is formed.
- (4) placing the tile in the ground before the concrete has sufficiently hardened to afford proper resistance to the solvent action of soil water upon the cement. The first three of these causes contribute to the production of a porous tile wall structure.

Coffins Made of Cement

A new and unique industry has been established in Houston, Texas, one that it is not so pleasant to contemplate perhaps, but which promises great development. It is impossible to wax very enthusiastic over the manufacture of coffins, but all will eventually need one, and by all economic ethics it is a perfectly legitimate business. At all events Houston is going to have, and as a matter of fact has today, a casket plant. Moreover, this plant is putting out a new kind of product—caskets of cement, water-proof and air-proof—that are as light, as attractive to look at, and as inexpensive as those of wood and metal.

This casket comes as an invention and is subject to a base patent. Mr. E. W. Hartman of Los Angeles is the originator. It is made of reinforced concrete, the aggregate being mixed according to a secret formula. The walls and sides are only nine-sixteenths of an inch in thickness, yet will sustain an air pressure of 88 pounds to the square inch. The casket is capable of being finished in any of the conventional styles—covered with cloth, bronzed to resemble metal, or polished and tinted to represent marble.

A representative of the United States government purchased one of these caskets, without letting the manufacturers know what it was wanted for, submerged it in 30 feet of water for three months and when it was taken out the silk linings were not damp.

The Houston plant is the second one Mr. Hartman has organized, and has as its exclusive trade territory the states of Texas, Oklahoma, Louisiana and Arkansas, besides being in a splendid position to handle the Mexican and South American markets.

Mr. Hartman is predicting big things for the factory here. He has also made arrangements to organize plants in Cleveland, St. Louis, Chicago, Boston and other Eastern cities. To a representative of the Houston Chronicle he said:

"I have located a plant here, which I am sure is going to mean something to the industrial advancement of the city, a plant which does not involve a heavy capitalization, but which will employ from 100 to 150 men when it's in full operation. I am quite convinced of what it will do because I have seen what was done in Los Angeles."

The Chicago Cement Burial Vault and Casket Company, 5301 Ravenswood avenue, Chicago, are also manufacturing cement caskets.

Concrete Work in Winter

Jacob Confer, 1117 Mason street, Toledo, is home after a winter's work on bridges and other concrete work near Grand Rapids, O.

He formerly was master mechanic of the Toledo & Ironton railroad and has had wide experience in bridge building and other construction work.

"The idea of doing no concrete work in winter is an unnecessary delay," said Mr. Confer. "With the heavy demand for concrete work and its greater use in building there is no reason why work should be abandoned five months in the year. At Grand Rapids we used stoves and straw to keep concrete from freezing, but the nicest way is to use steam. I worked for five years in northern Michigan in the upper peninsula, and we did concrete work the whole winter. By the use of steam and a tarpaulin or canvas the work can be done nicely. The tarpaulin can be put over the concrete as the work advances and the steam turned under this canvas for 24 hours."

Mr. Confer's work at Grand rapids was a new state market road.

The Effect of Excess Water in Concrete

BY DUFF A. ABRAMS,

Professor in Charge Structural Materials, Research Laboratory, Lewis Institute, Chicago.

Concrete is made of a mixture of three materials of entirely different characteristics—cement, aggregate and water. These materials, or any two of them, may be mixed in all proportions; however, it is only a certain range of possible mixtures (which must include cement and water) that is useful as a structural material. A certain proportion of cement must be used in order to secure the requisite strength; a certain quantity of water is necessary in order to develop the hydraulic properties of the cement and to produce a plastic mix; economy dictates the use of aggregate in the mix.

Experience has indicated about what proportions of cement and aggregate must be used to give concrete of the necessary resistance for a given purpose, but little attention has been given to the inter-relation of the effects of varying quantities of water on the resistance of the concrete.

A thorough investigation of this subject is in progress at the Structural Materials Research Laboratory. These tests have shown the following relations to obtain:

1. With a certain aggregate of the same grading and sufficient water to produce a concrete of a given plasticity, the strength of the concrete, within the usual range of mixes, is proportional to the quantity of cement in a unit volume of concrete.

2. With a given aggregate and the same quantity of cement, the strength of the concrete is a maximum with the smallest quantity of water which can be used to produce a plastic mix; any increase in the quantity of water is accompanied by a very rapid falling off in the strength of the concrete.

3. With a given aggregate mixture, the same quantity of cement, and sufficient water to produce a concrete of definite plasticity, (a) the strength of the concrete increases with the "coarseness" of the aggregate up to a certain limit; (b) this limit of "coarseness" is higher for a larger quantity of cement and lower for a smaller quantity of cement; (c) the limit of "coarseness" of the aggregate which it is feasible to use varies slightly with the character of the material, being somewhat lower for a mixture of sand and crushed stone than for sand and well-rounded pebbles, and lower still for mixtures in which crushed stone or similar material is used as fine aggregate.

4. For given proportions of cement and aggregate the quantity of water required for a definite plasticity depends largely on the grading of the aggregate and to only a minor degree on the character of the material, shape of particles, etc.

5. For a given aggregate, the quantity of water required to give concrete of the same relative plasticity is directly proportional to the quantity of cement.

If we assume that concrete materials of suitable character are at hand, and that mixing and other details are properly cared for, the engineer generally has the following alternatives for improving the quantity of the concrete:

- a. More cement
- b. Coarser aggregate (within certain limits)
- c. Less water (limited by the necessity of producing a plastic mix)

Economy dictates the use of the smallest quantity of cement which will produce concrete of the desired resistance. The tendency has been during recent years to use entirely too much water; in many instances the water used is 50 to 100% in excess of the quantity which gives the highest strength, resulting in concrete of not more than 25 to 50% the strength that should have been obtained with the same cement and aggregate and a proper quantity of water. While some sacrifice in strength is generally necessary in order to secure concrete which may be handled and placed at low cost, it is absurd to sacrifice 50 to 75% of the strength which is practically available in this way. While the injurious effect of excess water in concrete has been given little attention, a great deal of emphasis has been placed on the benefits to be derived from the use of coarse, well-graded aggregate.

The experimental work referred to above has already thrown much new light on this subject. We are forced to the conclusion that the chief advantages of well-graded and coarse aggregate as compared with poorly-graded aggregate comes from the fact that the concrete can be mixed to a workable plasticity with less water, and not to any inherent difference in the behavior of aggregate of different sizes. In other words, while coarse, well-graded aggregate is highly desirable, little or nothing is gained by using aggregates of the highest grade unless we take advantage of the fact that it can be mixed with correspondingly less water. This makes it apparent that many of the shortcomings of concrete made of fine or poorly-graded aggregate should be charged to the additional water required to mix the concrete.

It is as important that an upper limit be placed on the quantity of water as it is that a lower limit be placed on the quantity of cement in the batch. It would be just as consistent to specify the quantity of aggregate and water and leave the proportioning of the cement to the judgment of the mixer foreman, as to specify the quantity of cement and aggregate and leave the proportioning of the water to the mixer gang. Exactly the same effect is produced by the use of an excess of water as by a deficiency in cement; and it is more important now that special attention be given to the water in concrete, since the present methods give reasonable assurance that the proper quantity of cement is used.

All the benefits which may arise from using good cement, coarse, well-graded aggregates, thoroughly mixing the concrete, etc., are completely nullified if an excess of water is used in the mix.

"In mixing concrete use the least quantity of water that will produce a workable mix, then give the concrete as much water as possible after it has begun to harden," is the only safe rule to follow. The amount of water which should be used with given materials cannot always be determined in advance; it will also vary with the nature and size of the work. However, every effort should be made to keep the water content of the concrete at a minimum. It is not feasible to use the quantity of water corresponding to the highest possible strength of concrete (a similar statement may be

made with reference to the "coarseness" of the aggregate), yet this difference should be reduced to a minimum by using the smallest practicable amount of water.

The abuse of the water element in concrete has come about solely from the fact that it is cheap, and frequently facilitates handling and placing. Much of the concrete which is being made at the present time could be greatly improved, at no additional cost, if the owner

were compelled to pay, say, $\frac{1}{2}$ to 1 cent per gallon for all water going into the mixer. In many respects it is unfortunate that water is not an essential element in the cost of concrete.

Probably the greatest improvement which can be made in our present methods of manufacturing concrete will come from a better understanding of the very injurious effect of excess water and a saner practice in proportioning this important element of the mix.



Battery of 14 Polk System Bins (10 circular—4 interstice) Circular Tanks 20'x54'—Capacity 190,000 Bushels., Iglehart Milling Co., Evansville, Indiana, Owners.

New Polk-Genung-Polk Catalog

Readers will be interested in the new Polk system grain storage, coal pocket and water tank catalog. The pages of this booklet show the successful use of concrete in grain storage, coal pocket and water tank construction by means of the Polk system.

Re-enforced monolithic concrete for grain tanks, circular coal pockets and water towers has steadily and surely come into its own. That grain and elevator men now recognize in re-enforced monolithic concrete the material that is absolute proof against wind, lightning, fire, vermin and repairs is indisputable.

Coal dealers and users of stored coal also come to realize that circular re-enforced coal bins, equipped with the now well developed coal-handling machinery, offer the ideal storage—proof against repair—proof against fire—virtually indestructible.

The Polk system machine is an all steel equipment for building circular monolithic concrete structures.

Designed and manufactured by practical men with many years of experience, it builds structures exactly perpendicular, builds them true to a circle and with walls of uniform thickness at every point. It imposes no weight or strain on "green" walls, the entire weight of forms, scaffolding, and workmen being supported by a steel centermast. This centermast is the foundation principle of the Polk system machine, and it is by virtue of it and other good and wholesome design, that the machine secures the highest efficiency from the concrete mixtures thus producing flawless structures.

Monolithic concrete structures are ideal when they are built right. To be built right they must be scientifically re-enforced, they must be absolutely true to alignment, and during the course of construction there should be no strain on the "green" concrete walls. The forms used and the method of placing the concrete must insure a maximum efficiency from the concrete materials. The Polk system machine builds monolithic concrete structures right.

A copy of this catalog will be mailed free to interested parties by writing to Polk-Genung-Polk Co., Fort Branch, Indiana.

Investigation of Slag as Aggregate for Concrete

Strengths Averaging 50 Per Cent Higher Than Gravel Concrete at 28 Days Were Obtained—Requires 15 Per Cent More Cement

The relatively high strength of slag concrete is well known, but few tests have been made to compare the relative value of different slags and to study comprehensively the various qualities. Such an investigation and tests, described in a paper presented before the annual meeting of the American Concrete Institute by Sanford E. Thompson, consulting engineer, of Boston, are taken by permission from a report made by the author to the Stone & Webster Engineering Corporation for the purpose of determining the availability of slag as an aggregate for plain and reinforced concrete. Several series of tests were undertaken, and conclusions are drawn from these tests and from a study of previous investigations.

Conclusions Resulting from Tests

As a result of the tests the following conclusions have been reached:

1. The strength of concrete made with slag, such as is obtainable commercially in eastern and northern Ohio, was on the average about 50 per cent higher at the age

of 28 days than gravel concrete made with first-class materials.

2. Using the same proportions by volume as for gravel concrete, about 15 per cent more cement on the average was required per cubic yard for slag concrete than for gravel concrete of the same proportions.

3. No authentic cases of deterioration of slag concrete made with Portland cement or of rusting of steel embedded in such concrete have been discovered.

4. Porous slag produced a concrete of substantially the same strength at 28 days as dense slag. At later ages the dense slag is probably stronger.

5. Slag made by different processes and under different conditions showed no marked difference in strength and other characteristics.

6. An extremely hard, dense, acid slag did not produce a concrete of greater strength than porous, basic slag on a 28-day test.

7. The weight of the slag concrete tested averaged about 6 per cent lighter than an average gravel concrete. On the other hand, very dense acid slag concrete was heavier than gravel concrete.

8. Granulated slag sand produced a mortar of inferior tensile strength on short-time tests.

9. Crushed-slag screenings produced a mortar appreciably higher in strength than standard-sand mortar.

Tests thus far made for permeability of slag concrete are insufficient to determine its availability for thin water-tight work such as tanks. The weathering qualities of slag concrete are indicated as satisfactory by examination of structures which have been built for a number of years.

Specifications for Use of Slag for Concrete

The tests have not been extended over a long enough period to warrant final recommendation for specifications. It appears from the results thus far obtained that for practical construction:

Slag must be air-cooled, crushed, screened from dust, and free from foreign material. The weight of screened slag when shaken to refusal should not be less than 65 pounds per cubic foot.

On account of the nature of the slag, exceptional care must be used in proportioning, mixing, and placing, especially where concrete is chuted, to insure a uniform dense mix.

Commercial practice requires the banking of slags which are low in magnesia (say 1 to 2 per cent) for at least six months. Slags of higher magnesia content (say 5 to 6 per cent) appear to require a much shorter period of seasoning.

If the Joint Committee's method of basing allowable stress on strength of cylinders at 28 days is followed, it would be permissible to use with the slag concrete 50 per cent higher stresses than with gravel concrete, or, conversely, to use lean enough proportions in similar ratio. While so large a stress is not yet warranted without still more extended tests, the results indicate that where slag is accepted for use it is permissible to use at least 15 per cent less cement with the same stresses so as to put the slag concrete on the same basis, commercially, as gravel concrete. This would permit proportions 1:2½:4¼ in place of 1:2:4 commonly used in reinforced concrete. The slightly larger ratio of sand to coarse aggregate suggested is advantageous in filling the voids.

Further Tests Needed

Further information is desirable on long-time tests of slag concrete exposed to air and to moisture to compare the relative value of porous and dense slag as aggregates. Certain of these specimens should be ground so as to expose the aggregate to the weather. Permeability tests, tests of modulus of elasticity, and tests of expansion from changes in temperature and moisture also should be made.

Concrete Swimming and Wading Pools

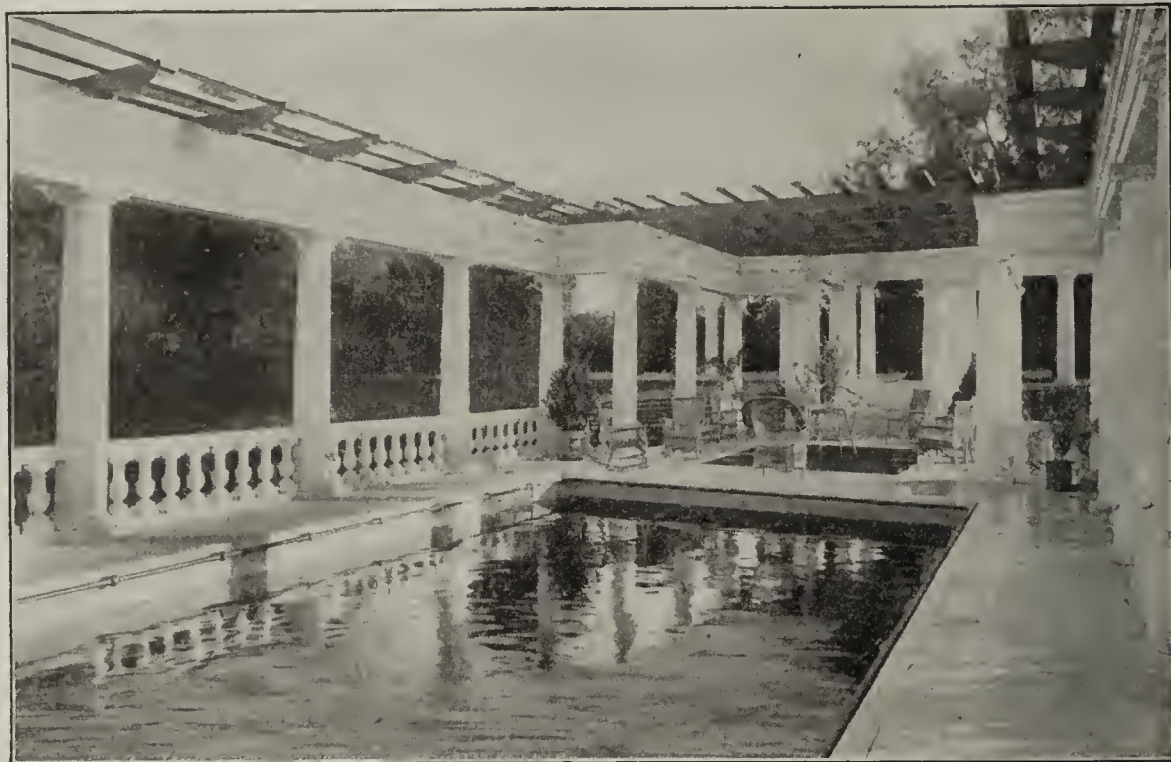
Swimming and wading pools are now being extensively constructed in towns and cities. The builder should therefore familiarize himself with their construction. The illustrations shown herewith are only a couple of types which may be changed to suit location and circumstances.

It may be necessary to arrange for dressing room facilities in connection with the outdoor pool. A shelter for this purpose may be a part of the architectural plan of the pool and its location, or may be a separate feature. The swimming pool itself requires few and simple furnishings or appointments. There should be a spring-board at one end. Usually handrails or handholds are placed around the inside of the pool, slightly above water level.

The season during which the outdoor pool may be used can be materially lengthened by providing facilities for

the entire exterior of the footing. The lowest point of this drain should be connected with another tile line leading to a convenient outlet low enough to insure uninterrupted drainage. After footing forms have been set up and braced, reinforcing for the wall should be erected, being assembled by wiring at all intersections, and temporarily stayed in position by supports placed above the fillet which forms the upper part of the footings. Reinforcing should also be temporarily secured to vertical supports so that it will remain correctly assembled and in proper position while concrete is being placed in the forms.

If concreting is to be carried on continuously, the exterior wall forms should be completely erected and reinforcing temporarily stayed to them at convenient intervals. Studding and braces for the interior wall forms



An Elaborately Designed Swimming Pool.

heating the water. Steam coils may be placed along one or more sides of the pool, hot water or steam being circulated from a hot-water boiler or steam plant. Exhaust steam where available is often sufficient to warm the water to the desired temperature. Probably the simplest method of warming the water is to circulate it through a hot water boiler. In such a case it is necessary that the boiler be set low enough in relation to the water in the pool so that the water will return to the boiler by gravity.

The large page illustration suggests a design for a standard type of swimming pool. If any change is made in the dimensions shown it will be necessary, of course, to modify accordingly certain details of the design such as decreasing or increasing the quantity of reinforcing necessary, as the size of the pool is decreased or increased.

Details of Swimming Pool

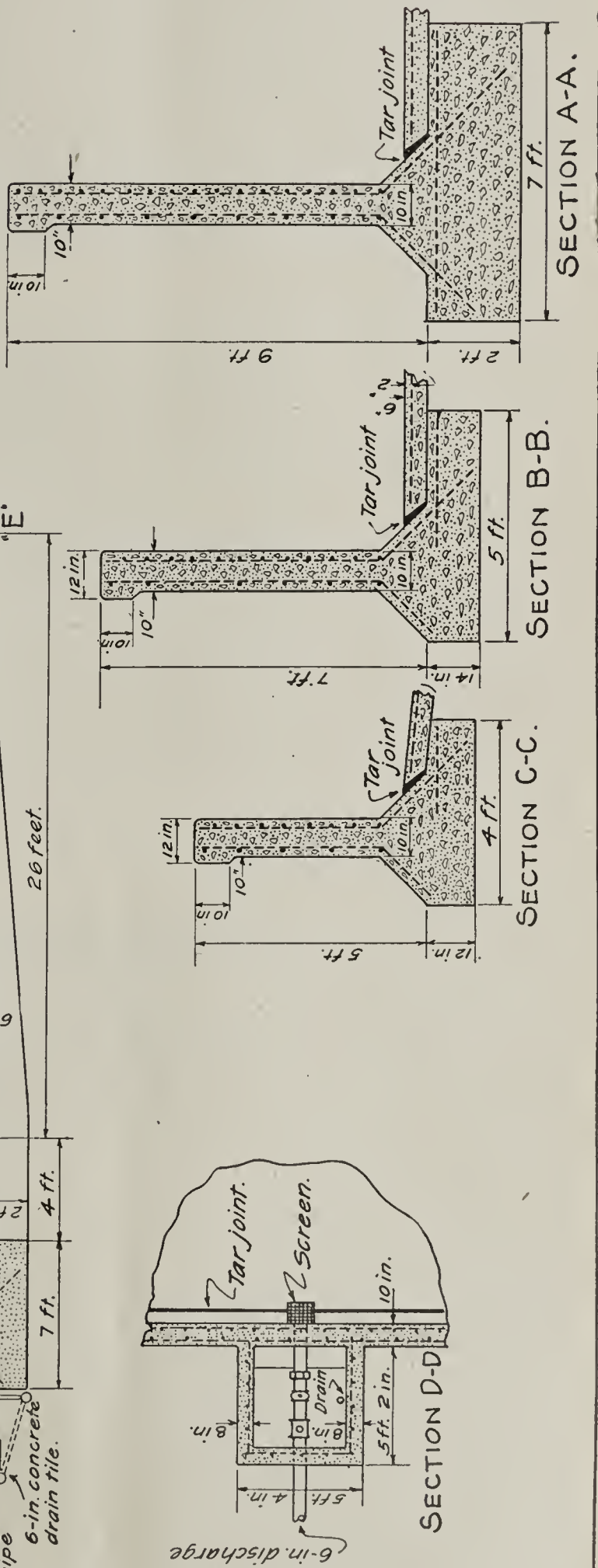
For those who are not familiar with the general requirements of swimming pool construction, the following suggestions, relating particularly to the construction of the pool mentioned, are offered.

Walls of this pool were designed on the presumption that the soil has a bearing power of at least 4,000 pounds per square foot. If the bearing power is less, the footings must be modified accordingly. In excavating for the footings the trench should be made large enough so that after setting up the form for the exterior of the footing there will be sufficient excavated space to receive the 6-inch concrete drain tile that is to be laid around

should also be completely erected so that when concrete is placed in all sections, each plank beginning at the top of the fillet can be successively placed in position while the wall is being carried to its full height.

If the placing equipment includes a spout on the discharge of the mixer that can be shifted at will over the section to be filled with concrete, forms may perhaps be boarded up completely inside as well as outside. In general, however, it will be found advisable not to board up inside forms the full height at once but rather as concreting progresses, since the depth of forms will make difficult proper spading next to the inside form face and thus prevent securing a good surface finish to the inside face of the wall. If concreting of footings and walls cannot be carried on continuously, the footing should be built up to the top of the fillet, at which level a notch 2 inches deep and 4 inches wide should be formed in the concrete by forcing a slightly beveled piece of 2 by 4 scantling into the soft concrete and allowing it to remain until the concrete has hardened. The slight beveling will make removal of this strip easier. The notch or groove formed in the concrete will assist in securing a better bond between the concrete of the footing and that deposited later when concreting of the wall is begun.

After the concrete in the footing forms is 24 hours old, forms may be removed and the lumber used as part of the wall forms, the exterior form being completely built as already mentioned after having removed the temporary supports which carry the reinforcing at the top



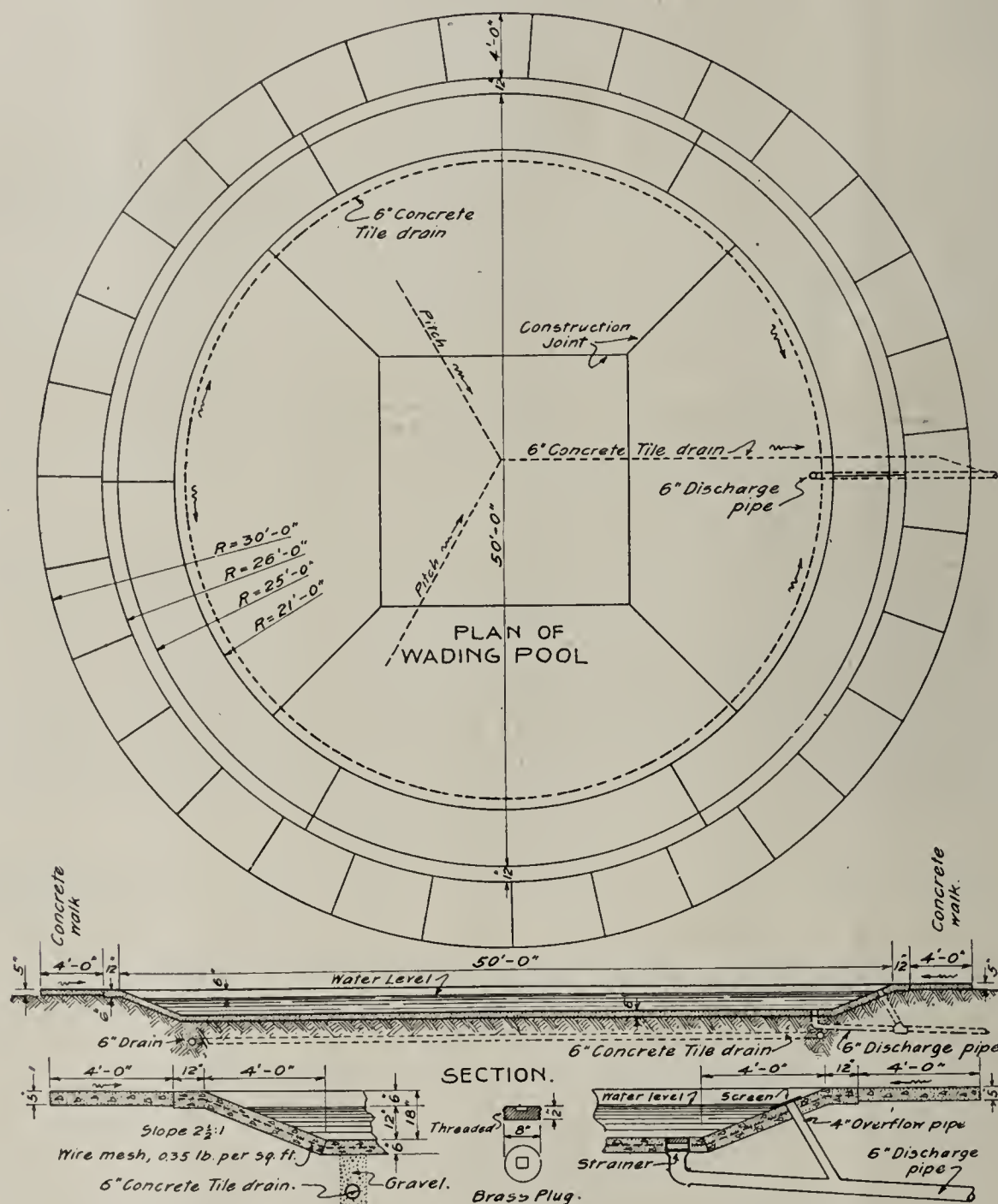
of the fillet. The upper ends of the reinforcing should then be temporarily stayed to the exterior forms to hold it in correct position while concrete is being placed.

If only bank-run gravel is available the material must be screened by separating it into at least two volumes, the sand being that material which will pass through a screen having 4 meshes to the linear inch, the pebbles being that material which will not pass this screen and which ranges from $\frac{1}{4}$ -inch particles up to those having a maximum dimension of $1\frac{1}{4}$ inches.

The concrete mixture for the entire construction should be a 1:2:3, which means 1 sack of Portland cement to 2 cubic feet of hard, coarse, clean, well-graded sand and 3 cubic feet of hard, clean, well-graded

Consistency of Concrete

It is very important that the consistency of the concrete be as described. A mixture containing less water than that required for a quaky consistency would have to be tamped in the forms, and watertightness would not be so certain to result nor would the desired bond or adhesion be secured between concrete and reinforcing metal; while if a sloppy mixture were used, water carrying cement would leak from the forms, or pockets would form around reinforcing when the concrete hardened, owing to the excess of water. If the concrete is proportioned 1:2:3, and has been placed as described, the structure will be watertight without necessity for any other treatment.



Design for Concrete Wading Pool.

pebbles or broken stone. Any cement meeting the specification requirements of the American Society for Testing Materials will be suitable. Water used for mixing concrete should be free from loam, clay, oil or alkali. Enough water should be used to produce a concrete of quaky or jelly-like consistency. Mixing should preferably be done by machine.

Concrete should be placed in layers not deeper than 9 inches, each successive layer being well spaded as placed, particularly against the inner form face but also against the outer form face and between form faces. Spading against form faces not only helps the concrete to settle to maximum density but forces back coarse particles from against the form, permitting the sand-cement mortar to flow to the face and thus produce a dense, watertight surface.

Concrete should be deposited in the forms within thirty minutes after it has been mixed. After half an hour, hardening action resulting from the chemical combination of cement and water will have progressed so far that if such concrete is used it will not finally develop its full strength. Concrete which has commenced to harden before being placed should not be retempered and used, that is, remixed by adding water and turning the materials.

Lumber dressed on one side and two edges and of uniform thickness, should be used for forms so that joints will be tight and the form face next to the concrete smooth. Forms should be well braced to prevent bulging due to pressure of the wet concrete. Under favorable weather conditions wall forms may be removed after 24 hours, but the back filling should not

be done until the concrete is at least four weeks' old, nor should the pool be filled with water for at least five weeks after the last concrete was placed. If there are any air or pebble pockets on the interior surface of the wall after forms have been removed, they should be at once filled with a 1:2 cement-sand mortar.

For at least ten days after wall forms have been removed, concrete should be protected from sun and wind by canvas or similar protective covering which will prevent the concrete from drying out, in addition to which the covering and the concrete itself should be wet down several times daily.

After wall forms have been removed the soil upon which the floor is to rest should be graded to proper level and slope, and wedge-shaped strips placed around the edge of the inner fillet. The concrete for the floor should then be placed, reinforcing being laid two inches from the top surface as shown. The concrete should be struck off by using a wooden strikeboard and given its final finish by hand floating with a wood float.

This plan contemplates that concreting of the floor will be continuous. If, however, it is impossible to carry on the work in this manner, then provisions must be made for a joint or joints that will make the floor consist of two or more slabs.

can be harvested and stored, the profit from the construction comes from utilizing it in this manner.

The design which has been described represents a pool of moderate cost. It has been planned with every regard for economy of materials and equal consideration for efficiency of design. The following estimate will enable one to determine the probable cost as influenced by the price of materials in the particular locality in question:

Portland cement	301 barrels
Sand	90 cubic yards
Pebbles or broken stone.....	135 cubic yards
Reinforcement	9,280 pounds

If lumber must be purchased solely for this work, about 6,000 feet board measure will be required. Hardware, such as nails, and miscellaneous tools, etc., are estimated at approximately \$125.

Wading Pools

Although many outdoor swimming pools, especially those which are planned with a view to public or semi-public use, are so designed as to include the possibility of being used as a wading pool also, nevertheless the depth of water at the shallow end of such pools is often greater than is safe for small children who cannot swim.



Circular Concrete Wading Pool, Design of Which Is Here Given.

After concreting of the floor is finished, the work must be protected in the same manner as was described for protecting the walls to prevent too rapid drying out of the concrete. Two inches of moist sand or earth, kept wet by frequent sprinkling, will serve the purpose. This should be left in place for at least ten days, after which the strip at the outer edge of the floor may be removed and hot tar or asphalt poured into the space between floor and fillet, to seal the joint.

Overflow and discharge pipes should be provided for as shown. It is particularly necessary that for inexpensive operation the facilities for filling and emptying the pool be as simple as possible to arrange. The pool should be located so that gravity flow will empty it when necessary to change the water for cleaning the pool or for other reasons.

Unless the water supply is from a source that furnishes pure clear water, it is desirable to arrange to filter the water before passing it into the pool. Sparkling cleanliness of the water contributes much to the pleasure of bathing in the outdoor pool and to the feeling of security when diving.

Some who have constructed swimming pools for private use have made such structures a source of actual profit. A properly designed and constructed concrete swimming pool may be allowed to freeze over in winter and will then provide a private skating rink, or if one is so situated that the home supply of ice

Many public parks have added to their free-for-all enjoyment features a wading pool in which small children can splash at will and race their miniature yachts. A suggested design for such a pool is shown herewith. As planned, the maximum depth of water is uniformly 12 inches. This maximum can be decreased, if desirable, by placing the outlet lower, thus lowering the water level correspondingly. This pool has an overall diameter of 50 feet. A sloping pavement permits easy entrance to the water. The construction throughout should be of 1:2:3 concrete, mixed and otherwise handled as recommended in the construction of the swimming pool described elsewhere.

As this pool is shallow the excavation necessary for its location may not extend to sufficiently firm soil upon which to lay the floor, and if so, this area must be compacted by rolling or otherwise, so as to secure a firm foundation for the floor slabs. If the soil is sandy or of a nature that drains readily, no subbase will be necessary. If the soil is not well drained the excavation should be made 10 or 12 inches deeper than actually necessary for the floor level and this 10 or 12 inches filled with clean, well compacted gravel containing little sand, or with clean cinders free from ash. This subbase should be well compacted by tamping or rolling.

The drains should first be laid in trenches as indi-

cated, and provisions also be made for the discharge and overflow connections.

Reinforcing, which in this case is shown as wire fabric weighing at least .35 pound per square foot, should be laid at the center of the 6-inch concrete slabs constituting the floor and the rim of the pool. Details of this work are identical with those followed in one-course sidewalk and pavement construction.

A concrete walk 4 feet wide surrounds the entire pool. This walk is 5 inches thick and the same preparation of the foundation should be made for supporting the slabs, which are approximately 5 feet long, as was recommended for the floor of the pool. Likewise those precautions which were recommended for protecting the concrete of the swimming pool against too rapid drying out should also be taken in this case, the concrete being covered with a protective layer of moist sand or earth—this covering being kept wet for several days.

On account of the sloping sides of the pool formed by the slabs that constitute its rim, there is little or no possibility of the pool being injured by allowing the water to freeze. For this reason the pool will form a safe skating pond in winter for the children.

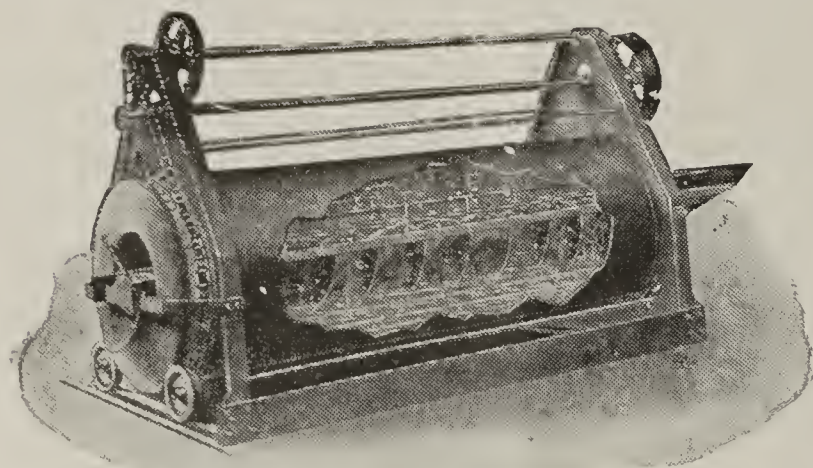
Below will be found an approximate estimate of the quantities of materials necessary to construct a wading pool of the plan and dimensions shown:

Portland cement	91 barrels
Sand	27 cubic yards
Pebbles or broken stone.....	41 cubic yards
Reinforcement.....	735 lbs. of wire fabric
	.35 lb. per sq. ft.
Concrete tile	190 feet of 6-inch

Sand and Gravel Washer

A machine is put out by the Stocker Concrete Material Washer Co. designed to permit the fulfilling of the demand for clean sand, gravel, crushed stone, etc., for concrete work at only slightly increased cost. The Stocker washer is made in various sizes, portable and stationary.

It is all metal, end frames of cast iron and the revolving drum sheet steel. On the inside of the drum are riveted



The Stocker Washer.

angle iron bars, to which steel strips are riveted. Material fed into the end from which dirty water is discharged goes through a series of agitatings and liftings until it arrives at the other end and is delivered into the hopper for clean material. Clean water enters at the end from which clean material is emitted. Thus the washed material passes through cleaner water with each successive stage of its journey through the drum, the final stage being a rinsing in clear water after practically all the dirt has already been removed.

Cement and Engineering News, 672 Transportation Bldg., Chicago, will gladly send you a catalog fully describing this washer.

Better Each Year

The Ideal Concrete Machinery Company, 1352 Monmouth avenue, Cincinnati, reports rapid advancement in perfection of its "Ideal" Cincinnati mixers during the past season. These betterments are expected to give greater value and efficiency to the user.

"We have learned many valuable lessons from our customers and are adopting every suggestion that proves of value to the buyer, so that each year's model is good—very good—better," said G. B. Hopkins, secretary and treasurer of the company, in a recent interview.

The company, starting in business in 1904, has been specializing in the manufacture of mixers of the smaller size only, building 5, 7, 10 and 14 foot capacities. They are built in the various types, with non-tilting drum, to meet the requirements of all kinds of contracting work.

The engineering department of the company, after studying the vibrating effects of gas engine equipments has adopted a vertical type of engines in the three larger sizes of mixers. Their experiments proved that the pounding of the reciprocating parts of the horizontal engines caused severe vibration of the entire mixer frame, whereas the piston thrust in the vertical engine is downward directly over the wheels of the mixer, reducing vibration to a minimum. The mixers are equipped with the Novo, Ideal or the New Way gas engines.

The Ideal Cincinnati Traction Paver in 7, 10 and 14 cubic foot capacity, is the result on the part of this company of a long period of experimental work and designing in an effort to produce a machine that would fill every demand of the paving contractor. These pavers are in extensive use in various parts of the country with every evidence of giving satisfaction.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912,

Of Cement & Engineering News, published monthly at 672 Transportation Bldg., Chicago, Ill., for April, 1917.

STATE OF ILLINOIS, }
COUNTY OF COOK. } ss.

Before me, a Notary in and for the State and county aforesaid, personally appeared Jno. F. Waldron, who, having been duly sworn according to law, deposes and says that he is the Business Manager of the Cement & Engineering News, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse side of this form, to-wit:

1. That the names and addresses of the publisher, editor, managing editor, and business manager are:

Publisher, Wm. Seafert, 672 Transportation Bldg., Chicago.

Editor, Wm. Seafert, 672 Transportation Bldg., Chicago.

Managing Editor, Dr. W. Michaels, 672 Transportation Bldg., Chicago.

Business Manager, Jno. F. Waldron, 672 Transportation Bldg., Chicago.

2. That the owners are: (Give names and addresses of individual owners, or, if a corporation, give its name and the names and addresses of stockholders owning or holding 1 per cent or more of the total amount of stock.)

Wm. Seafert, Sole Owner, 672 Transportation Bldg., Chicago.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.)

None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

JOHN F. WALDRON,
Business Manager.

Sworn to and subscribed before me this 23rd day of March, 1917.

[SEAL.]

OTTO A. KRATIK.

(My commission expires June 16, 1920.)

Cement Kilns and Blast Furnaces as Producers of Potash

It is a matter of common knowledge nowadays that the world's food supply is dependent on a sufficient amount of nitrates, potash and phosphoric acid in the soil in which crops are grown. These elements are constantly being removed from the soil by the growth of crops; and a large proportion is eventually discharged into the sea through the operation of modern water-carriage sewerage systems.

In order to supplement the slow processes of nature in restoring fertility to the soil through the decomposition of mineral matter, agriculture in all civilized countries has come to rely largely on artificial fertilizers, the chief ingredients of which are the three elements above named. Of these three, nitrogen is obtainable from the air, both by the processes of plant growth and by recently developed electrochemical processes. Of mineral phosphate, the United States has enormous deposits. For potash, however, the United States, in common with the rest of the world, has had to rely upon the mines of Germany.

Since the outbreak of the war, which cut off the supply of potash from Germany, the problem on which thousands of earnest workers have been engaged has been the development of a supply of phosphate from native sources. There are vast amounts of potash contained in certain rocks. Feldspar, for example, contains a large percentage; but methods of concentrating this potash and putting it into marketable shape on a commercial basis are yet to be developed. Within the last few months, however, it has been discovered that the dust discharged from the cement kiln and from the blast furnace, which has hitherto been chiefly important because of the nuisance that it creates, is rich in potash and in a form that makes it directly available for use as a fertilizer.

In *Cement and Engineering News* of July, 1916, Arthur C. Hewitt, chief engineer of the Security Cement and Lime Company, of Hagerstown, Md., described the pioneer plant that his company has established for collecting the dust from its cement plant for use as a fertilizer. This plant with its five kilns in operation is producing 20 to 25 tons of dust per 24 hours, containing 5 to 10 per cent of pure potash in the form of a sulphate. At the Security plant the Cottrell process of dust precipitation is used.

There would appear, however, to be a still simpler method of extracting a large part of the dust from cement-kiln flue gases. At the recent annual meeting of the American Society of Mechanical Engineers a paper was read by Arthur D. Pratt on "Steam Boilers for Utilizing Waste Heat." One section of this paper was devoted to the application of waste-heat boilers to cement kilns. The gases leaving the end of a cement kiln are at a temperature of 1300° to 1800° F. The opportunity for utilizing their heat for generating steam is obvious; but up to the present time, according to Mr. Pratt's paper, only four cement plants in the United States have installed waste-heat boilers. These are the plants of the Cayuga Lake Cement Co., at Ithaca, N. Y.; the Sandusky Co., at Dixon, Ill.; the Burt Co., at Bellevue, Mich.; and the Louisville Co., at Speeds, Ind.

Mr. Pratt's paper describes in detail the large saving effected through utilizing the waste heat for generating steam, and he also devotes some space to the action of the waste-heat boilers in extracting dust from the waste gases. This dust, according to Mr. Pratt's paper, is merely taken back and fed to the kiln again. The dust is largely composed of burned or unburned cement clinker carried along by the blast, and its feeding back

into the kiln has saved the use of just so much raw material.

It is evident, however, that the composition of the dust deposited from the kiln gases will be the same whether it is precipitated by the Cottrell electrical process or whether it is deposited in the course of its passage through the boilers and their settings. If the raw materials used at the plants named are as high in potash as those used at the Security plant, it is evident that the dust collected at the boilers should be as valuable for fertilizer in the one case as in the other.

According to the figures given by Mr. Pratt, the dust collected at the Burt plant amounts to about 2½ tons per kiln per day, or about 3 per cent of the total weight of material fed to the kiln. At the Louisville Company's plant the boiler setting and the flues connected with the kilns are specially designed with the object of settling out as much dust as possible to avoid collection of dust on the boiler tubes. The dust collected at the Louisville plant amounts to 3.9 per cent of the total weight of the kiln charge. This appears to be a little more than half the amount of dust collected from the kilns at the Security works by the Cottrell process, which Mr. Hewitt gives as 4 to 5 tons per kiln per 24 hours.

From these figures, a Cottrell process plant to treat the flue dust after passing through the waste-heat boilers might be worth while. Such a plant could be considerably smaller and would involve less difficulty in construction and operation than the plant installed by the Security Cement Company, since it would deal with the gases at much lower temperature, probably 400° to 500° instead of 1300° to 1800°. The cooler gases would occupy a much smaller volume, and there would be less difficulty with the apparatus on account of the intense heat.

The question that naturally arises is where the potash comes from which is thus collected. Mr. Hewitt's paper is silent on this point. An interesting light is shed upon it by a paper entitled "Potash as a By-product from the Blast Furnace," by R. J. Wysor, superintendent of blast furnaces of the Bethlehem Steel Company. This paper is published in the January "Bulletin" of the American Institute of Mining Engineers.

It appears that the Bethlehem Steel Company is collecting the dry dust deposited by the blast-furnace gas passing through the furnace stoves and boilers and has shipped 1,073 tons of this dust in the 15 months since April 1, 1915, to July 1, 1916. This is the dust collected from the operation of four 500-ton blast furnaces, and it will be obvious that the amount of potash recovered from the blast furnace is a much smaller percentage of the material fed into it than is the case with the cement kiln.

This is partly due to the fact that at present only a very small percentage of the potash discharged from the blast furnace is saved. An extensive investigation carried out by the Bethlehem Steel Company, of which Mr. Wysor presents the results in his paper, shows that only 1.3 per cent of the potash present in the materials charged into the blast furnace is recovered in the dust now collected. A considerable part of the potash is lost in the slag and in other ways which cannot be prevented, but there are various possible methods by which a much larger proportion of the potash could be recovered, provided it were commercially advantageous to do so. The Bethlehem plant has in fact experimented with a Cottrell dust precipitator and has found it practicable to collect a dust with an average of 10 per cent potash content.

In discussing the source of the potash in the blast furnace Mr. Wysor expresses the opinion that the chief

source of the potash is feldspar or clay mixed as an impurity with some of the materials entering the blast furnace. These impurities perform no valuable function in the operation of the blast furnace; on the contrary, the effect of the alkali on the firebrick lining of the hot-blast stoves is exceedingly injurious.

While in the blast furnace clay occurs only as an accidental impurity, in the cement kiln it is one of the main elements in the charge. It can readily be understood therefore why the cement kiln promises a much larger possible output of potash as a byproduct than does the blast furnace. Should the collection of potash as a byproduct become a permanent feature of cement manufacture, it may become worth while to study the chemical composition of different materials available for cement production. It is entirely probable that great variation will be found in the potash content of the various clays and limestones used; and by choosing materials rich in potash, it may be possible to increase materially the profits of a plant from its sales of potash dust.

Of course, any commercial determination of the future possibilities of potash production from the cement kiln will be dependent on the market prices for potash after the German mines are again available to the world. Even though cheap potash from abroad were to make it unprofitable to collect potash from cement works located on the Atlantic Coast, however, it might still be profitable for cement plants in the remote interior, where the freight rate makes imported potash costly, to manufacture byproduct potash to supply the local demand for fertilizers.

There is every reason to believe that the demand for chemical fertilizers to maintain the fertility of soils is destined to increase enormously the world over. Fertilizer manufacture is like cement manufacture in that the value of the product per ton is so low that there is a strong tendency for the manufacture to spread all over the world. It is quite within the possibilities, therefore, that the wide distribution of Portland-cement manufacture may have an important relation to the maintenance of soil fertility and the world's food supply.

Concrete Fence Posts

Concrete fence posts are far better than wooden and cost less. They get stronger with age. Never rot, rust, nor burn. Stand straight and do not heave easily. Each post is a lightning arrester. They beautify the landscape and enhance the value of the farm. Have been adopted by leading railroads, U. S. Government, State Experiment Stations and progressive farmers everywhere. Note what the U. S. Department of Agriculture has to say as to the comparative advantages of concrete and wooden posts. This is taken from Farmers' Bulletin 403, issued May 21, 1910:

"As a material for the construction of fence posts, concrete has not only very few of the disadvantages and practically all of the advantages of wooden posts; but it is also superior to timber in some respects. In the first cost concrete posts may be more or less expensive than the best wooden posts, according to the locality. This depends upon the timber supply, the deposits of gravel and rock, and the skill exercised by the person making the concrete posts.

"If manufactured as usual and cured for three months, concrete posts are as good as the best wooden posts of the same size. After three years' service wooden posts possess only from one-third to one-half of their original strength, whereas, concrete grows stronger with age and needs no repairs, for neither weather nor fire injures it. Under ordinary circumstances good concrete posts will last forever; and even if a few, in

the course of years should be broken by unusual strains it is cheaper to replace these than to replace an entire fence of decayed wooden posts with posts of material with the same lack of durability.

"Concrete posts are attractive in appearance because of their uniformity of size and color, and because of their durability, they effect a saving in giving greater life to the fencing material used, so that the permanent value of the property is increased."

One of the conclusions reached by the Committee on Signs, Fences and Crossings of the American Railway Engineering Association is as follows:

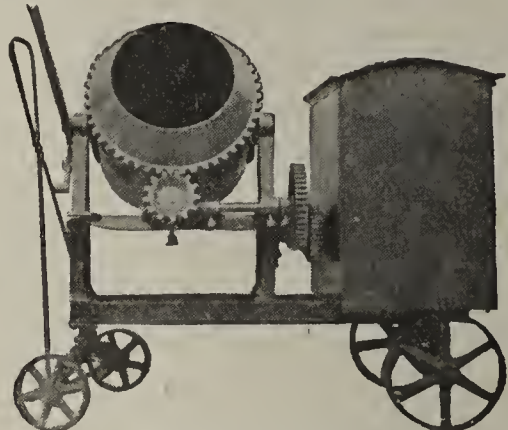
"Concrete posts are practical, economical and a suitable substitute for wood."

The W. E. Dunn Mfg. Co., 414, 24th street, Holland, Mich., manufacture concrete fence post molds and they will be glad to send any of our readers their catalog and prices.

Republic Small Concrete Mixer

Our readers will be interested in the following illustration showing a new model, light weight mixer for the small contractor and builder. Nearly every building contractor has a number of small jobs on which a small light mixer could be used to good advantage and profit for such work as sidewalks, basements, floors, foundations, etc. A small contractor with limited means who has been doing work by hand or a large contractor who has small jobs on which it would not pay to move a big mixer, will find this small machine a splendid and profitable investment.

It is so light that two men can move it around easily and one that is capable of turning out a large day's work if necessary, handling up to 35 yards of mixed material per day.



Republic Small Concrete Mixer.

A number of new principles and constructions is used. The drum operates on ball bearings, making it very smooth and light running and requiring but little power. Reverse action is used for discharging, which makes it much speedier and more effective in dry materials. For mixing material for block and tile plants it is also unsurpassed, and is a machine suitable for handling anything from a very wet to a very dry mix, including brick mortar.

Full information and catalogs may be secured by addressing the Republic Iron Works, 116 Patterson street, Tecumseh, Mich., who also manufacture a complete line of concrete machinery.

Kansas Limestone Found Good Material For Roads

Experiments with the limestone found in Kansas show roads can be built of it at an average cost of \$6,000 a mile. Under the proposed law if each of the 105 counties were to build an average of 100 miles of hard surface road on a basis of twenty-year 4 per cent bonds, the average cost would be 3½ cents an acre annually, or 83 cents an acre for the entire time.

Best Practice in Concrete Road Construction

BY H. ELTINGE BREED, FIRST DEPUTY COMMISSIONER,

New York Commission of Highways.

The title recalls one of the most elated moments of my life. It was when I stood on the rostrum at prep school to read my essay, "The Best Methods of Becoming a Success"—but there the similarity ends. If I spoke then about all life with conviction, I speak now about concrete roads with circumspection. If I then covered the whole world fearlessly, I now limit my remarks tentatively to New York State, for to dogmatize about best practices in concrete road construction before a body of men like yourselves, would be presumption on my part. What I can tell you that may be of interest, is simply what the experience that we have had in building concrete roads in New York State has led us to believe is good practice at present. That ways of improving it may be suggested is one of my hopes in reading this paper.

First of all, we must prepare the design and specifications.

Design

A standard is almost established for thickness and crown, but it must be kept variable to meet different conditions of sub-soil and density of traffic; if the traffic is to be heavy, the road must be built proportionately thicker.

Grades

Grades are still treated differently in different sections of the country. Our original practice was not to exceed five percent, but today we are building them as high as eight per cent under certain conditions. Grades to be limited only by the ability of the wet concrete to run during the process of construction, by the character of the mix, and the kind of traffic to use it. Even on a steep grade, the use of a coarse sand prevents the road from being slippery; and I believe that brooming of the surface facilitates the traction hold of all classes of traffic. Floating should be at a minimum as this operation brings the finer particles to the surface, which gives a smooth top.

Width

Most of the roads we have been building in New York State are sixteen feet in width. This is because when the money was appropriated to build our system, it was on the basis of approximately thirteen thousand dollars per mile. That was a low figure even at the time, in 1912; at present it is obviously impossible to complete the system as planned then. Only by the strictest economy, by substituting different classes of pavement within certain limits of cost, and by Federal aid can we expect to have all of our important roads brought together into a good highway system. It would be far better, however, and ultimately more economical, if we had sufficient funds to build them eighteen feet in width. For two lines of traffic on a concrete road eighteen feet should be the minimum width; for three lines, twenty-four feet.

The use of motor vehicles is steadily increasing; they are being built wider and wider. Hence they require pavements where vehicles at least ninety inches in width can constantly and comfortably pass one another. Eighteen feet is probably the narrowest width to allow this. Especially is this true of concrete roads because the transition from the hard concrete surface to the earth shoulder and back again

becomes really dangerous in some soils on account of the rut that traffic usually wears along the joining line.

Square-Cornered Edges

In design, the edge of the concrete slab next to the shoulder should be vertical and square-cornered. Then if it becomes necessary to reinforce the shoulder with road metal, a good joint can be made; and, more important still, if additional widening is required, it can be accomplished with a longitudinal joint of minimum size. We have very satisfactorily widened some miles of concrete roads built throughout the state in accordance with this design by adding four feet or more to one or both sides of the pavement.

When the soil for the shoulders is unstable we are intrenching it with crushed stone or gravel four to six inches deep and one and one-half to three feet wide. Although this gives good results, and makes for additional safety, still, if much traffic must be turned onto them, the maintenance cost of these stone and gravel shoulders is so high as to justify the additional first cost of a wider pavement.

Accidents on Sixteen-Foot Roads

In order to obviate the danger of accidents on our sixteen-foot roads we have been widening or mooning out the curves so that in some cases for those of small radius at the center the actual curve is as much as twenty-two to twenty-four feet wide. We have also considered it good practice to give the outside of these curves a superelevation in order to make easier the steering of a car, to lessen the likelihood of skidding, and to insure greater safety in taking these curves at speed. This has been objected to as inducing people to travel around the curves at high speed, but speeding seems to be an inherent mania, unrelated to external conditions, and certain it is that banked curves lessen the casualties resulting from it.

Specifications

Cracking of a concrete pavement is due generally to the unequal settlement of a poor subgrade. If the road is to be satisfactory it is of first importance that a good subgrade be secured. These we consider the essentials of a good subgrade:

1. It must have uniform bearing power. If an old roadbed is to be used, it must be sacrificed, reshaped, and re-rolled for the entire width of the pavement, removing all large stone to a depth of six inches.

2. It must be dry. Ditches should be low enough to take away the water from under the pavement. With unstable soil good results can be secured by providing subdrains and spreading a layer of gravel—preferably run-of-bank gravel—over the subgrade to increase its stability. Materials used for this purpose must be impervious; if it is porous it will act during wet periods as a reservoir, which under conditions of frost, will break the pavement proper.

3. It should have metal reinforcement (a) under very bad, that is, unequal soil conditions; (b) whenever the supporting power of the subgrade changes, as from rock to earth, or passing over a trench.

Our experience indicates that the expense of reinforcement is not justified in gravelly or sandy soils where good natural drainage prevails.

The Mix

The mix should be proportioned in such a manner as to give the greatest density. With our requirements

*Paper presented at the Fourteenth Annual Convention of the American Road Builders' Association, Boston, Mass., February 5-9, 1917.

for materials we have found that the proportions of one to one and one-half to three most nearly do this. Our specifications provide that the concrete shall be mixed in the proportions of one volume of cement to four and one-half volumes of sand and broken stone or gravel, and the proportions of fine and coarse aggregate are varied slightly as a result of field void tests so that the greatest density is obtained. Should the size or character of the materials change, there would be a corresponding change in the proportioning of the mixture.

The coarse aggregate should consist of a well-mixed product of clean No. 1, No. 2 and No. 3 stone or gravel.

No. 1 size is that retained on a $\frac{3}{8}$ -inch circular screen and passing a $\frac{5}{8}$ -inch circular screen.

No. 2 size is that retained on a $\frac{5}{8}$ -inch circular screen and passing a $1\frac{1}{2}$ -inch circular screen.

No. 3 size is that retained on a $1\frac{1}{2}$ -inch circular screen and passing a $2\frac{3}{4}$ -inch circular screen.

It is provided, however, that not more than twenty-five per cent of the total shall be No. 1 size, the proportions being so graded as to give a minimum of voids.

Aggregates should never be used unless they comply with the tests prescribed.

You may note that we allow, as our maximum size, stone that will pass a $2\frac{3}{4}$ -inch ring, whereas most specifications permit only $1\frac{1}{2}$ -inch stone as a maximum. This may seem radical, but our reason for the increase in size is that we get equally as good if not better results from the larger stone, and at a cost decidedly lessened by our using more nearly the product of the crusher. Especially is the price to be considered on contracts where the local supply is crushed on the ground, this change is worthy of your consideration. We save fifteen per cent in crushing costs by this use of stone larger than the previously-accepted standards.

From a practical standpoint a pile of stone graded from $\frac{3}{4}$ to $2\frac{3}{4}$ inches has more stability when properly mixed than stone graded from $\frac{3}{4}$ to $1\frac{1}{2}$ inches. In our 1916 work we used stone up to $2\frac{3}{4}$ inches in size. As an indication of the compressive strength per square inch of field cubes tested at an age of 28 days we have a grand average of 3,370 pounds per square inches for 504 cubes of stone and gravel, of which only $13\frac{1}{4}$ per cent were under 3,000 pounds. Greater density can be obtained by using stone up to $2\frac{3}{4}$ inches in size and with the larger size stone, there is less probability of spalling at joints and along edges.

Sand

Concrete pavement sand should be such that one hundred per cent should pass the one-fourth-inch screen; not more than twenty per cent should pass a No. 50 sieve, and not more than six per cent should pass a No. 100 sieve. However, where more than twenty per cent of the sand passes a No. 50 sieve, where it is well graded to give a low percentage of voids and where it conforms to all other requisites, special permission for its use may be given by the chief engineer. Sand may be rejected if it contains more than five per cent of loam or silt. All sand to be acceptable should have a compressive strength equal to Ottawa sand when tested in proportion of one part cement to three parts sand at the same age, same consistency, and using the same brand of cement as for Ottawa sand in the same proportions. It must be free from organic matter and any coating of grains.

Method of Mixing

The concrete should be mixed in approved mechanical batch mixers. Mixing should be continued at a speed of not less than ten revolutions nor more than

sixteen revolutions per minute, for at least one minute after all materials are in the drum and before any discharge is made.

If at any time during the progress of the work the temperature is so low that in the opinion of the engineer in charge of the work it will within twenty-four hours drop to thirty-five degrees, Fahrenheit, the water and aggregates should be heated and precautions taken to protect the work from freezing for at least ten days. Should these temperature conditions persist for two consecutive days, permission should be obtained from the chief engineer before proceeding. He will lay down such requirements of procedure as may be permitted. Such procedure should be only for emergency work. In no case should concrete be deposited on a frozen subgrade.

Tests

Theoretical tests are fine. They are necessary to tell you what you should have as a final product. You proceed on the hypothesis they offer and then you have to wait until service and climatic conditions prove how far your hypothesis conforms to reality.

Tests for concrete materials have never been given their proper consideration, with the exception of cement, which has been tested with all the finesse of the art of testing. In general, little, if anything, has been done on the sands, which have been casually accepted if they looked good or had even been used before in a structure that would stand up. As for the stone or gravel, all kinds and conditions of both have been used with practically no tests at all.

Our work has shown that if we are to omit any of the tests, we might better take a chance with the cement, for of the last 455,000 barrels used, only 1.4 per cent failed to conform to the test of the American Society for Testing Materials. Fifty per cent of these failures was due to flash set and fifty per cent to failure on the two-hundred-mesh sieve requirement. Had all this cement been used, that rejected for sieve requirement would have given good work, and that rejected for flash set would have been aged enough by the time it was placed in the work to give good results. There has been a far greater proportion of both sand and stone rejected for this kind of work.

Engineering skill presupposes judgment, so why not inject it into our problems? After priming ourselves with theory, let us apply it to practice. Let us make field tests that will parallel laboratory experiments; let us conduct our laboratories in such a way that their value may be significant to the man in the field, and so that their results may be checked up by him. Success of work depends upon the field man; in every case his personality helps determine the results. Put him in line with your tests, practices, etc., and his interest and co-operation will show most profitably in the work. All of our men, from the engineer in charge of the road up, are instructed in all the tests and methods of inspection and they complete them on every inspection of the work. We of New York State believe that our best results may be attributed to the *esprit de corps* engendered by this method.

Field Tests

The principal tests which can be made in the field accurately enough for all practical purposes are:

(1) Graduation Tests for Sand.—Our field men are furnished with sand testers which have the one-fourth-inch, the twenty and the fifty sieves. By using these they can be assured of getting a uniform product from the bank, for they would at once detect any change for the worse in the character of the material and would reject it. Each engineer is supposed to make a daily report of the graduations. A laboratory test, how-

ever, is essential to ascertain the presence of any deleterious matter in the sand.

(2) Test for Loam and Silt Content in Sand.—This can be made in the field and checked up by the laboratory results. For the loam test, an excess of water is added to a given quantity of sand in a glass graduate; the whole is well agitated and allowed to stand until the loam and silt have settled on top, when their percentage may be measured.

(3) Test for Set.—This is made by mixing the sand with cement and forming a pat with thin edges. By breaking the edges after twenty-four to forty-eight hours it may be determined how the material sets.

(4) Tests for Stone and Gravel.—Field determinations of these materials can be made only for voids. Visual inspection should, of course, detect soft material and dirty aggregates. Such inspections on the road and at the quarry should be made constantly, to know that the material is running uniformly and is equal in quality to the original samples. When we realize that nature never has two deposits alike, the importance of these tests in securing good work will be readily appreciated.

Laboratory Tests

Laboratory tests of stone are so familiar to us all that I omit discussion of them here.

For gravel, however, we found that the rattler test in general use did not give a true abrasive value. Because of the rounded structure of the rattler, the first material that was abraded off formed a protective cushion that greatly decreased the subsequent wear upon the stone. To eliminate this condition a new pot of the same size and shape as the standard pot was designed, but it is slotted at intervals to prevent cushioning by allowing the worn-off material to escape. Some of the better-known gravels which have proved successful in concrete pavements are used as standards of comparison, with satisfactory results. We have also had promising results in using this pot to test slag, which in the old pot used to act the same as gravel did.

Final Test of the Concrete

Concrete from a batch mix is made up on the road into six-inch cubes, two in number, from every five hundred cubic yards of material. They are cured for twenty-one days in moist sand and then shipped into the laboratory and tested for twenty-eight days. The results of these tests are given to the engineers on the work, and the rivalry to have the highest test value produces good results. It is expected that these cubes will go over three thousand pounds per square inch compression, and if they don't we look for trouble. Of 504 cubes tested in 1916, only thirteen and one-fourth per cent were below three thousand pounds and the determination of the defects were as follows:

	Per Cent.	
	1916	1915
Coarse aggregate coated	61.9	35.0
Fine aggregate containing an excess of loam or made up of excessively fine-grained sand	25.7	43.9
Coarse aggregate, poor quality	6.2	8.2
Poor manipulation in making cubes	6.2	16.9

These tests also show a grand average of 3,370 pounds compression for all 1.1½:3 mix cubes stone and gravel, while the average for the stone cubes is 3,380 pounds and the average for the gravel cubes is 3,080 pounds. Thus it is demonstrated from these tests that stone concrete is eleven per cent stronger than gravel concrete. In comparing the two, it is fair to say that all gravel with a coating that ordinary washing will not remove should be rejected. While stone that retains much of the dust of fracture is bound to make

weak concrete; this is especially true of all soft limestones, and of any stone that is crushed when it is wet.

Construction

An exact subgrade is necessary to save the concrete that would be wasted in evening up inequalities in the foundation. The extra time and attention spent on getting an exact subgrade will be well repaid.

The materials should be placed well in advance of the laying, so that when the mixer has once commenced operations the work may be continuous. If the road is being constructed of imported materials, the use of a stock pile to prevent shortage will materially reduce the loss from delays in operation. In order that the minimum amount of work may be done in taking materials from the subgrade and placing them in the mixer, it is advisable that the superintendent and foreman should each have a list of the amounts to be distributed for every hundred feet. A little attention to this detail will save largely in the item of labor.

Rejection of Materials.—Materials should be rejected before they are unloaded to come on the work. As good quality is essential in both sand and stone, both these materials should be checked up from day to day in order to secure the best results.

Equipment.—Attention should be given to the screed or strike board, or template, as it is often called. This should be heavy enough to screed the concrete properly, and it should be cut to conform to the crown of the road. It should be provided with handles and be shod with a steel angle-iron, bent to the shape of the roadway. Wooden floats should be provided for doing the necessary floating, and the float to be used at a joint should be split in such a manner that it will ride over the joint smoothly and will cover an area of at least one foot on either side of the joint. Steel forms, while more costly than those of wood, are far more economical in the long run and pay for themselves in a short time.

Measuring barrows should be of such a type that their measurement can be regulated by the bolting of boards across the rear part of the barrows to make the quantities adjustable. Forks should be provided for taking the stone from the subgrade in order to eliminate the dirt.

To insure a sufficient supply of water a pipe line should be installed, for although tank supply may amply provide the mixer, it can scarcely take care of that and attend to sprinkling, too.

The concrete road presents a good problem for the application of labor-saving devices in the handling of materials, and many different installations have shown reasonable cost reductions. The industrial railroad has played a large part in this.

The forms should be placed in such a way as to give them stability, and they should, above all, be tight. The subgrade should be kept drenched with water immediately ahead of the laying of the concrete.

An ordinary concrete force in operation on a sixteen-foot road is comprised of from thirty-two to thirty-five men, doing all branches of the work; and it is quite often necessary to rearrange the gang so that the best results may be secured in keeping the mixer in continuous operation.

Suitable measuring tanks should be provided so that the amount of water may be such as to make the separate batches of the same consistency, the ideal consistency of concrete being such that it will just settle and will not run. This is very important as the density of the resulting concrete is dependent upon it; if too wet, the materials will run on the grades.

The concrete should be well spaded and kept high above the screed or strike board on the mixer side.

Tamping should not be allowed. In screeding, the screed should be slowly pulled back and forth, advancing it slowly with each operation. When approaching a joint the screed should be brought up to the joint and carried back in order that the surface may be uniform. No more floating than is absolutely necessary should be resorted to, as the primary object is to have the wear on the surface taken by the stone and not by the thin mortar layer produced by floating.

Joints should always be perpendicular to the surface of the pavement. If they were not, in subsequent expansion there is often riding of the slabs. In many instances, it may be necessary to stiffen up the consistency of the concrete in order that the screeding on grades will not give a ridgy effect. If possible, all work on grades of over four per cent should be worked uphill. The cement factor should be taken daily and reported to the division engineer.

Curing properly is as necessary as good construction, for upon this depends to a large extent the strength of the resulting concrete. Sprinkling should be commenced as soon as the surface will not pit, and a cover of two inches, at least, of sand or loam should be spread over the surface. This cover should be kept saturated with water for ten days. Care should be taken, however, not to place cover until the concrete is sufficiently firm to withstand the impact caused by placing. Sprinkling should be done in such a manner as not to wash the cover from the surface. When the temperature gets below fifty degrees, Fahrenheit, in the middle of the day, sprinkling and cover may be omitted. When concrete is laid in cold weather, its curing period should be lengthened, as low temperature retards its gain in strength. Work done in November should be allowed to cure from four to six weeks.

It has been our aim to designate essentials in design and specifications; to hold only such standards as have been proven practical, from our field and laboratory tests; and to employ only such methods of construction as will insure serviceable pavements at the lowest possible cost.

As you are aware, I have not attempted in this paper to cover the subject fully. Limitation of time, to say nothing of other limitations, would not allow that. I have tried to suggest features which may sometimes lack sufficient attention, and to emphasize other features of whose importance we feel certain. In conclusion, let me say that the ideas presented in this paper are based upon such knowledge as may be gained by inspection of concrete pavements in various parts of the country, and, more validly, on the actual construction in New York state of two hundred and one miles of second-class concrete pavement, 1:2½:5 mix, a type which we have ceased using; and upon the actual construction of three hundred and sixty-four miles of cement concrete pavement, 1:1½:3 mix, built in the last four seasons. There still remain one hundred and twenty-seven miles of this type of construction under contract in New York.

The Joint Report on Concrete

A final report has been made by the Joint Committee on Concrete and Reinforced Concrete, an organization formed by the union of special committees appointed in 1903 and 1904 by the American Society of Civil Engineers, the American Society for Testing Materials and the American Railway Engineering Association and later by the Portland Cement Association and the American Concrete Institute. Earlier reports were presented in 1909 and in 1912. The report has been printed in the proceedings of the American Society of Civil Engineers for December, 1916.

The report is not intended as a complete specification but rather as an authoritative manual of the general principles governing the design, detail and con-

struction of concrete and reinforced concrete structures. In many respects this last report differs only slightly from that of 1912, although on some subjects considerable new information is given. The report specifically endorses the effectiveness of good concrete as a protection to any embedded steel reinforcement. It states also that, while some concrete and reinforced concrete structures have been injured by flow of electric currents, under ordinary voltages the chance for injury by electrolysis is slight and that non-reinforced concrete structures are practically immune from troubles of this kind. However, warning is given against the use of salt or calcium chloride in structures subject to appreciable electric current. While confirming current opinion to the effect that the damage to sea walls can be largely accounted for by frost action, the remarks on the effect of sea water indicate that further investigation is desirable before definite conclusions can be reached on this important phase of the use of concrete. This is true also of the report on the effect of alkalis. Of acids it is stated that dense concrete thoroughly hardened is affected appreciably only by acids which seriously injure other materials. Substances like manure that contain acids may injuriously affect green concrete but do not affect concrete that is thoroughly hardened. Concrete is reported immune from harm by such mineral oils as petroleum or ordinary engine oils but is vulnerable to fatty oils which form compounds with the lime.

In the discussion of cement Portland cement alone is approved in reinforced concrete work, natural cement being limited to mass concrete where comparisons of proportions giving equivalent strength show natural cement to be cheaper. Puzzolan or slag cement is excluded from use in important work and is limited to unimportant foundation not exposed to air or running water.

Under the specifications for aggregates, blast furnace slag is specifically excluded, "especially for reinforced concrete construction," with the statement that no satisfactory specifications or methods of inspection have been developed that will insure a uniform material. Cinder concrete is permitted in reinforced concrete slabs not exceeding 8 feet in span and in mass concrete.

The specifications for both sand or, what is termed "fine aggregates," and the coarse aggregates are very brief. For crushed stone and gravel this consists in requiring them to be "clean, hard, durable and free from all deleterious matter. Aggregates containing dust and soft flat or elongated particles should be excluded." In the specifications for the fine aggregates no attempt is made to describe sand that will produce strong mortar, but instead it recommends that all fine aggregates should be tested for the strength of mortars made from them. In this connection caution is given against the removal of any coatings on the grains which may affect the strength and that bank sands should not be dried before making them into mortar but should contain the natural moisture.

Reinforcing bars are limited to those made from billet steel and conforming to the specifications of the American Society for Testing Materials.

Under mixing, there are rather extended remarks concerning machine mixing with relatively little comment on hand mixing. The former calls for the use of a batch mixer and a minimum of 1½ min. mixing time in the mixer, with 2 min. for mixers of two or more cubic yards capacity. Particular stress is placed upon this matter of the time allowed for mixing as indicated by the following quotation:

"Since the strength of the concrete is dependent upon the thorough mixing, a longer time than this minimum is preferable. It is desirable to have the mixer equipped with an attachment for automatically locking

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the discharging device so as to prevent the emptying of the mixer until all the materials have been mixed together in the mixer. Means should be provided to prevent aggregates being added after the mixing has commenced. The mixer should also be equipped with water storage, and an automatic measuring device which can be locked is desirable. It is also desirable to equip the mixer with a device recording the revolutions of the drum. The number of revolutions should be so regulated as to give at the periphery of the drum a uniform speed; about 200 feet per min. seems to be the best speed in the present state of the art."

In covering the subject of the placing of concrete some space is devoted to the proper methods of spouting. The plant should be of such proportion as to insure a practically continuous stream. "The angle of the spout with the horizontal should be such as to allow the concrete to flow without separation of the ingredients, in general an angle of about 27 deg. is good practice. Tremies are recommended for concreting under water with drop bottom buckets as a second choice.

The chapter on details of construction covers joints, shrinkage and temperature changes, fireproofing and waterproofing. The splicing of bars by lapping is approved on the basis of safe bond stresses, although the use of splices in main tension bars should be avoided. No mention is made of the use of clamps of any form. The section on waterproofing states that a concrete made as dense as possible by proper proportioning and suitable consistency will be impervious to moderate pressures. The use of membranes of asphalt or coal tar preparation is also mentioned. Under surface finish the report states that "concrete is a material of individual type and should be used without effort at imitation of other building materials" and also that "the natural surface of concrete in most structures is unobjectionable."

The chapter on design, which has not been changed to any extent except for the addition of a section on flat slab construction, offers an authoritative and conservative guide to the designer of concrete structures. This applies also to the chapters on working stresses and the appendix containing formulae for design. These will prove of great value to engineers in any designing office.

Some Slow Volume Changes in Portland Cement

By Edward D. Campbell*

Engineers have realized for many years that free lime and magnesia may cause dangerous expansion in Portland cement and have sought by specifications covering chemical composition and physical tests to eliminate trouble from these two sources. Free lime can be readily detected and its deleterious effect prevented by proper ageing of cement before use. Free magnesia, on the other hand, cannot be as readily detected and the expansion due to the presence of free magnesia does not manifest itself to any great extent in the length of time or under the conditions usually employed in testing Portland cement. It is for this latter reason that engineers who consider the safety of structures as the first requisite, usually specify a maximum allowable per cent of magnesia, low enough, so that under no conditions of ordinary practice and manufacture the amount of free magnesia could be large enough to produce serious results. If the total magnesia is kept under 3 per cent no trouble will arise from this cause under any circumstances.

On account of very extensive deposits of limestone too high in magnesia to permit its use in the manufac-

ture of Portland cement if the allowable per cent of magnesia is kept down by specifications to 3 or 4 per cent, efforts have been made to produce from these magnesian limestones Portland cements which would satisfactorily pass all the physical tests to which these cements are usually subjected. Cements containing 7.5 or even 9 per cent magnesia have been prepared which have stood the ordinary physical tests and showed no abnormal expansion after intervals of 6 or even 9 months' immersion in water. Anyone not familiar with the slow rate of hydration of magnesium oxide would naturally conclude that a cement which gave no abnormal expansion after 9 months' immersion might be trusted in any work. It is because of this mistake that we are submitting some measurements which have been carried on in continuation of work described by the author in conjunction with Alfred H. White some ten years ago.

In this article, "Some Conditions Influencing Constancy of Volume in Portland Cements," the preparation and testing of a number of samples of cement of different degrees of basicity, some containing free lime, others free and combined magnesia, was described. The expansion measured by means of a special micrometer on bars 100 mm. in length was expressed in per cent, the measurements being made at increasing intervals of time. The time intervals selected were 7, 14, 21 and 28 days; 2, 3, 4, 6, 9, 12 and 18 months; and by intervals of 1 year each after the second year, the longest time recorded being 5 years from the time a given bar was made. The influence of chemical composition and ageing of the cement or clinker on the volume changes was studied and the conclusions in part summarized as follows:

"Free lime in Portland cement will not only not be slaked during the mixing and setting of the cement but will not become completely hydrated even when the cement is immersed in water, until about 14 days have elapsed. The result of this gradual slaking is to produce abnormal expansion of the cement. Any evil effects due to the presence of free lime in cements kept under water will be manifested within 2 months. In case free lime is present in cement used in structures above ground or where it is usually dry, the expansion due to hydration of the cement will be more gradual but several times greater in volume than when the material is under water. The expansion due to free lime slaking in the air may become so great after several months as to cause complete disintegration.

"The deleterious effects of free lime may be completely removed by ageing the ground cement or storing the clinker to weather until the pat will stand a perfect boiling test. Weathering the clinker for 3 months is usually sufficient. It is difficult to state the length of time necessary properly to age ground cement to eliminate free lime. It will not ordinarily be less than one month and may be much longer according to the conditions under which it is stored.

"Cement which passes a perfect boiling test may safely be assumed to contain no free lime. The expansion of a bar of neat cement containing no free lime when kept in cold water for 7 days is usually under 0.040 per cent, but occasionally it may go as high as 0.060 per cent. A cement with 2.8 per cent free lime showed an expansion of 0.220 per cent in the same period.

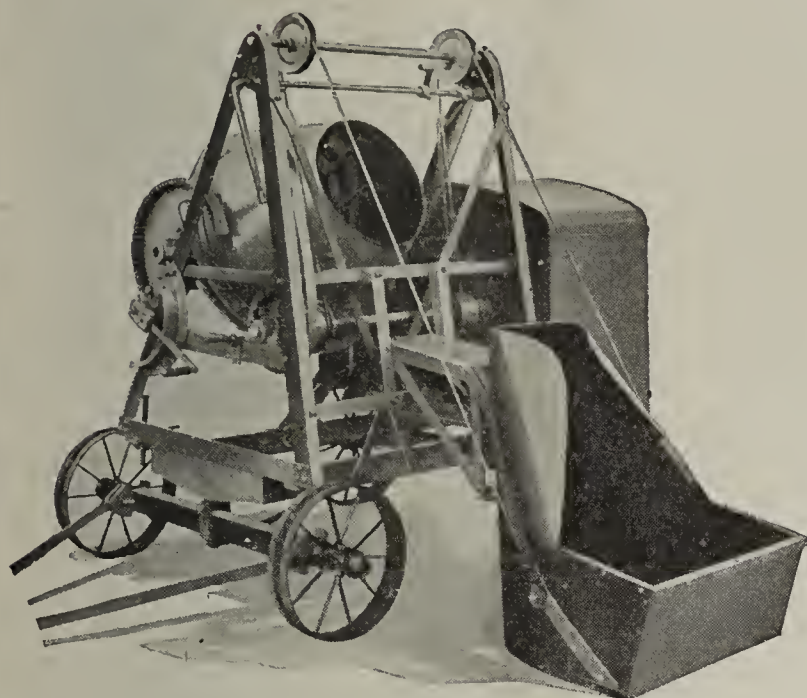
"The effect of magnesia, like that of lime, depends less upon its total amount than upon the form in which it exists. Combined magnesia like combined lime has no injurious effect in Portland cement. Magnesia combined with silica and alumina forms a hydraulic cement which is safe, but as compared with Portland cement is too weak to be of any commercial value. Free magnesia has no appreciable effect in cement used above ground where it is continuously dry. If the ce-

*From the Journal of Industrial and Engineering Chemistry, 1J. Am. Chem. Soc., 28 (1906), 1273-1303.

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ment is wet for a part of whole of the time, the free magnesia will very slowly hydrate and cause expansion. Even where the cement is continuously immersed in water the expansion due to free magnesia is not appreciable until after 2 months and becomes distinctly evident only after a year. The hydration seems to be well under headway only at the end of the first year and expansion continues at an increasingly rapid rate for at least 5 years and probably longer. Ageing does not seem to diminish the deleterious effect of free magnesia in cement. This is to be expected, since the rate of hydration of hard-burned magnesia in air is almost imperceptibly slow.

"The boiling test for 24 hours does not detect free magnesia as it does free lime. Cement containing as high as 4 per cent of free magnesia has passed a perfect boiling test, yet the last measurement of this cement at the end of 5 years in cold water showed a total expansion of over 1 per cent, nearly half of which occurred during the fifth year after making.

"This slow hydration of free magnesia with its accompanying expansion seems to be the probable cause of the expansion, frequently accompanied by more or less complete disintegration, so often noted in sidewalks, occurring several years after the walk has been laid.

continued, some of the periods being extended up to 13 and 14 years. As the purpose of the present paper is to call attention to the slow volume change, no measurements of expansion for a period of less than one year are given Table 1, in which are shown the long-time measurements of expansion. If the short-time measurements are desired, reference may be made to the above-mentioned paper. A study of the figures given in the accompanying table seems to sustain fully the conclusions drawn from the results published 10 years ago. The continued expansion due to free magnesia long after 5 years is very clearly brought out, as well as the fact that if magnesium oxide is in the combined form it will produce little or no volume change.

In view of the fact that efforts are being made to utilize, as a source of raw material for Portland cement, limestones too high in magnesia to enable the production of a cement low enough in this constituent to be safe under any conditions of manufacture, attention should be called to the results of the long-time measurements on Expts. 74 and 79. Both of these cements contain about 7 per cent total magnesia, but Expt. 74 contains 0.53 per cent less silica and 0.67 per cent more calcium oxide than Expt. 79. The CaO ratio of Expt. 74 is 280.2 while that of Expt. 79 is 270.7 to 100 molecules of SiO_2 . In addition to the difference in basicity the raw material used in Expt. 74 was not

TABLE I—EXPANSION OF BARS OF NEAT CEMENT IN WATER.

TABLE I—EXPANSION OF BARS OF NEAT CEMENT IN WATER.																	
All measurements represent percentage variation from original volume. All measurements represent expansion.																	
Expt.No.		Months		Years												Remarks	
		12	18	2	3	4	5	6	7	8	9	10	11	12	13		14
74	A	0.370	0.423	0.447	0.499	0.550	0.582	0.592	0.611	0.625	0.665	0.678	0.688	0.688	0.710	0.720	Free CaO and free MgO
	D	0.102	0.121	0.164	.....	0.245	0.285	0.307	0.344	0.360	0.372	0.378	0.385	0.391	0.415	.....	Aged. Free MgO
75	A	0.355	0.383	0.390	0.407	0.370	0.432	0.424	0.407	.....	.....	.....	.....	.....	.....	.....	Free CaO and free MgO
	D	0.130	0.136	0.152	.....	0.177	0.188	0.185	0.204	.....	.....	.....	.....	.....	.....	.....	Aged. Free MgO
77	A	0.130	0.163	0.158	0.170	0.180	0.190	0.180	0.166	0.188	0.195	0.189	.....	.....	.....	.....	Good cement used fresh
	D	0.028	0.032	0.040	.....	0.052	0.056	0.051	0.060	0.063	0.061	0.053	.....	.....	.....	.....	After aging
78	A	0.390	0.414	0.412	0.421	0.441	0.451	0.441	0.428	0.457	0.460	0.458	.....	.....	.....	.....	Fresh. Free CaO
79	A	0.160	0.204	0.218	0.250	0.330	0.310	0.310	0.312	0.344	0.380	0.377	0.380	0.376	0.410	0.410	7.2% MgO. Fresh
	C	0.089	0.104	0.127	0.145	0.177	0.194	0.187	0.211	0.226	0.230	0.233	0.224	0.230	0.251	.....	7.2% MgO. Aged
80	E	0.095	0.117	0.140	0.180	0.212	0.222	0.247	0.262	0.278	0.279	0.285	0.285	0.300	.....	.....	7.2% MgO. Aged
	A	0.032	0.057	0.062	0.082	0.100	0.102	0.091	0.072	0.098	0.107	0.102	.....	.....	.....	.....	All magnesia. Fresh
82	A	0.010	0.029	0.040	0.059	0.080	0.080	0.088	.....	.....	.....	.....	.....	.....	.....	.....	All magnesia. Aged
81	B	0.077	0.082	0.090	0.099	0.105	0.113	0.107	0.118	0.120	0.121	0.114	.....	.....	.....	.....	Same as 78, but aged
	C	0.049	0.051	0.059	0.071	0.070	0.078	0.072	0.081	0.085	0.085	0.073	.....	.....	.....	.....	Same as 78, but aged
83	E	0.050	0.068	0.062	0.081	0.092	.....	0.071	0.091	0.100	0.091	0.090	.....	.....	.....	.....	Same as 78, but aged
	G	0.089	0.103	0.101	0.115	0.121	0.115	0.104	.....	0.125	0.122	0.122	.....	.....	.....	.....	Same as 78, but aged
83	A	0.100	0.112	0.116	0.132	0.139	0.144	0.140	0.149	0.150	0.155	0.150	0.145	0.143	0.154	.....	Commercial cement, fresh
	B	0.095	0.106	0.117	0.134	0.144	0.146	0.146	0.165	0.169	0.170	0.163	0.168	0.160	0.173	.....	Same + 1% free MgO
83	C	0.113	0.133	0.150	0.170	0.190	0.203	0.200	0.255	0.223	0.232	0.232	0.240	0.232	0.242	.....	Same + 2% free MgO
	D	0.127	0.151	0.168	0.197	0.253	0.382	0.525	0.862	1.002	1.072	1.069	1.072	1.067	1.097	.....	Same + 3% free MgO
83	E	0.158	0.172	0.223	0.290	0.562	1.010	1.390	1.965	2.185	2.280	2.280	2.285	2.281	2.298	.....	Same + 4% free MgO
	F	0.093	0.106	0.110	0.119	0.129	0.130	0.122	0.140	0.131	0.140	0.139	0.137	0.133	0.141	.....	Same + 1% combined MgO
83	F	0.093	0.106	0.110	0.119	0.129	0.130	0.122	0.140	0.131	0.140	0.139	0.130	0.129	0.145	.....	Same + 2% combined MgO
	G	0.083	0.101	0.107	0.119	0.124	0.130	0.118	0.130	0.132	0.145	0.139	0.130	0.129	0.145	.....	Same + 3% combined MgO
83	H	0.090	0.101	0.106	0.118	0.130	0.138	0.125	0.148	0.147	0.150	0.149	0.140	0.143	0.160	.....	Same + 4% combined MgO
	I	0.096	0.104	0.110	0.120	0.130	0.135	0.128	0.150	0.150	0.155	0.152	0.150	0.147	0.160	.....	Same + 4% combined MgO
85	A	0.085	0.089	0.094	0.108	0.110	0.122	0.100	0.108	0.120	0.119	.....	0.121	0.116	0.130	.....	Same cement, aged
	C	0.067	0.074	0.079	0.091	0.100	0.104	0.086	0.099	0.110	0.108	0.095	0.101	0.092	0.110	.....	Same cement, aged
85	E	0.098	0.106	0.122	0.127	0.150	0.145	0.128	0.142	0.155	0.155	0.150	0.151	0.145	0.166	.....	Same cement, aged + 1% free MgO
	G	0.107	0.124	0.135	0.154	0.165	0.185	0.175	0.195	0.215	0.216	0.213	0.214	0.206	0.229	.....	Same cement, aged + 2% free MgO
85	I	0.115	0.136	0.154	0.185	0.240	0.370	0.474	0.740	0.890	0.894	0.930	0.895	0.891	0.909	.....	Same cement, aged + 3% free MgO
	K	0.141	0.175	0.199	0.282	0.615	0.944	1.311	1.522	1.575	1.581	.....	1.580	1.578	1.601	.....	Same cement, aged + 4% free MgO
85	M	0.082	0.093	0.096	0.109	0.115	0.119	0.106	0.120	0.130	0.135	0.125	0.120	0.117	0.083	.....	Same cement, aged + 1% combined MgO
	O	0.074	0.084	0.089	0.104	0.107	0.115	0.103	0.115	0.125	0.127	0.117	0.122	0.115	0.135	.....	Same cement, aged + 2% combined MgO
85	Q	0.070	0.080	0.087	0.108	0.099	0.109	0.101	0.118	0.130	0.131	0.125	0.128	0.120	0.169	.....	Same cement, aged + 3% combined MgO
	S	0.052	0.062	0.069	0.081	0.084	0.095	0.089	0.109	0.119	0.124	0.115	0.122	0.112	0.139	.....	Same cement, aged + 4% combined MgO

"One per cent or less of free magnesia in cements kept under water causes little noticeable expansion even in neat cement, probably simply filling up the voids. Increased percentages of free magnesia cause cumulatively greater expansion until with 3 per cent of free magnesia the expansion is too great to be at all safe.

"In the manufacture of cement from raw materials containing magnesium carbonate, some portion of the magnesia will remain in the free state. This amount will increase with coarseness of raw materials, increasing percentage of lime and increasing percentage of magnesia. If the total magnesia does not exceed 3 per cent it is not likely that well-made cement will carry enough of this magnesia in the free form to cause injurious expansion under any conditions of service. If the percentage of total magnesia rises above 3 per cent there will be increasing probability of enough magnesia remaining in the free form to cause injurious expansion."

Since the publication of the work summarized above, the experiments referred to therein have been con-

quite as finely divided as that used in Expt. 79. Although in Expt. 79 by keeping the basic ratio low and having the material very finely ground, a cement was produced with a total magnesium oxide per cent of 7.2, and which would pass all the ordinary tests to which cements would be subjected and which even after 13 or 14 years immersion had not expanded to any extent which would probably be dangerous, yet a relatively slight increase in the basic ratio and coarseness of raw material has shown in Expt. 74 very nearly double the amount of expansion taking place after the first year, this increased expansion being due to the increased proportion of free magnesia. It is this liability of having a dangerous amount of free magnesia in cements made from raw materials much higher in magnesia than is usually considered permissible for the best quality that should make manufacturers very cautious about adopting high magnesia raw material and if they do employ such material they should realize that much greater care in manufacturing will be required to produce a reliable cement than if the purer raw material were used.

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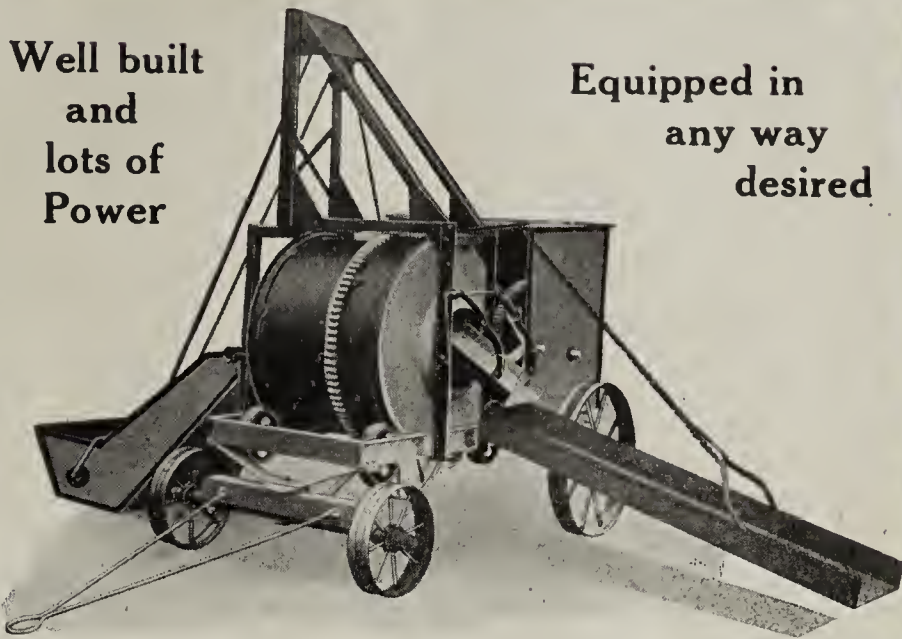
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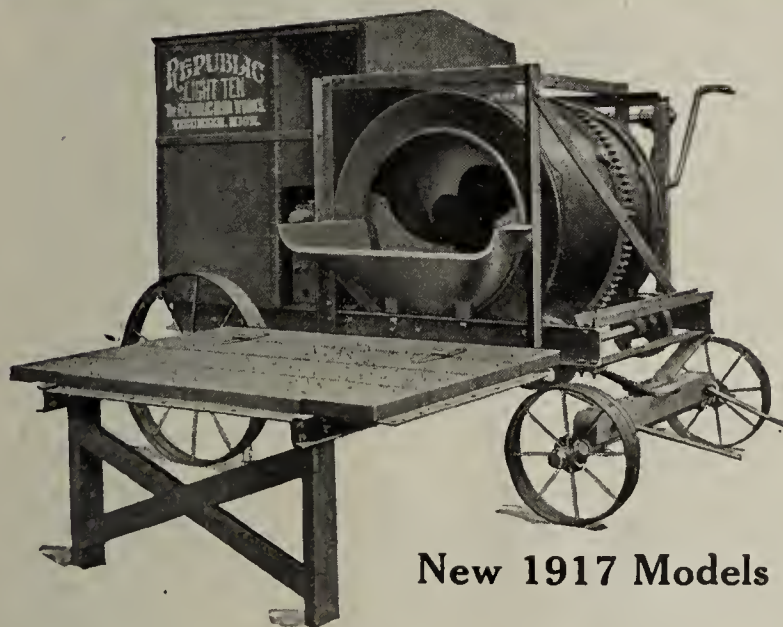
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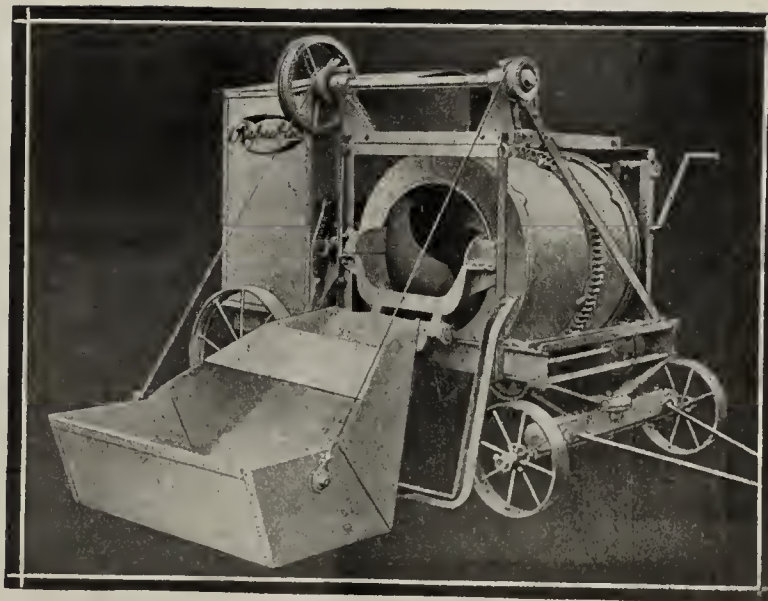


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Reliable as Steam—\$5 to \$10 a Day Cheaper to Operate

Hundreds in Use

Get Our Low Prices

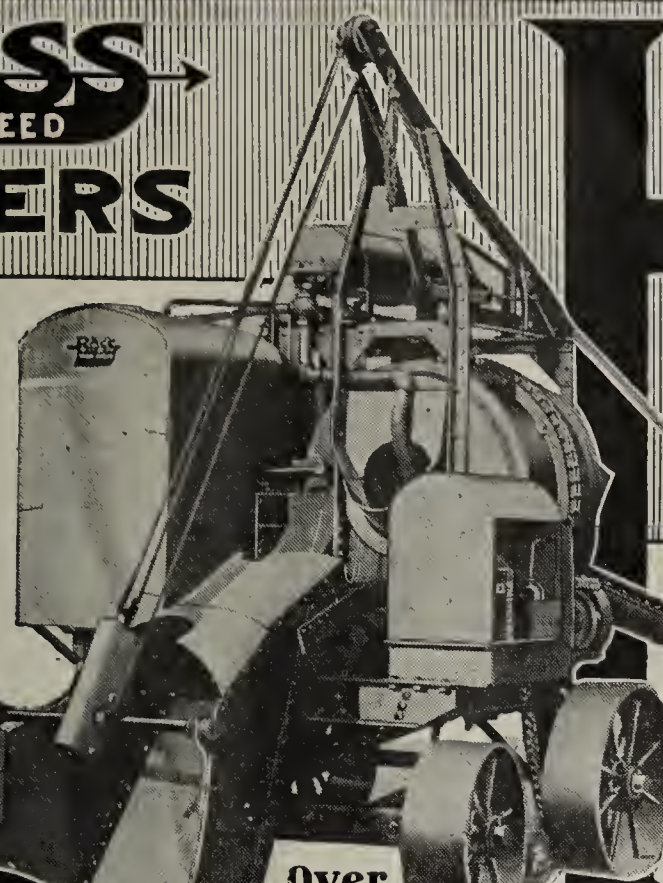
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SPEED MIXERS



Over 3,000 Boss Mixers At Work in the United States.

Used by
U. S. Government,
Geo. A. Fuller Co.,
Stone & Webster,
Lord Construction Co.,
Etc.

Stiff Competition Demands High Speed Mixers
It Will Pay You to Investigate



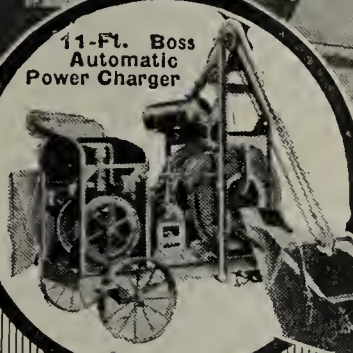
Fastest Charging—Mixing and Discharging Action Known
Built of Steel—Hyatt Roller Bearings
5-8-11-15-22-Foot Sizes
Side or End Discharge

Buy this wonderful LOW CHARGER
Big sack size at corresponding low prices

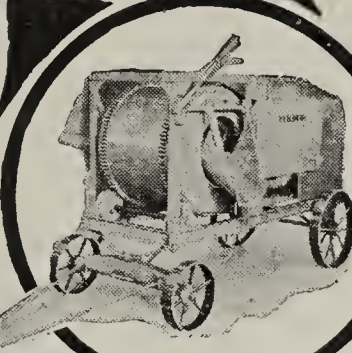
\$185

THE AMERICAN CEMENT MACHINE CO. INC.
HOME OFFICE AND FACTORY
Keokuk IOWA USA

New York Philadelphia Baltimore Richmond Pittsburg Indianapolis Cleveland Chicago Minneapolis Seattle Spokane S. Francisco Los Angeles New Orleans



11-Ft. Boss Automatic Power Charger





BULLETIN No. 1 covers the possibilities of Drain Tile as a business. This includes materials required, complete costs, selling prices and profits. It tells what others are doing in this business. How the demand is rapidly increasing and why cement tile are preferred by users.

BULLETIN No. 2 covers manufacturing. How to successfully start and operate a tile plant. Points to consider regarding location and building. Arrangement of equipment for best production. Describes different curing methods and relative costs. Tells what proportions of materials should be used and how mixed.

BULLETIN No. 3 deals with selling the product. Best methods to use for securing local business. How to get business from nearby towns. It also illustrates advertisements for use in local newspapers.

The Tile Business Fully Described

This instructive book on cement tile completely covers the three big subjects: **Possibilities of the Business, Manufacturing and Selling.**

It also describes suitable equipment for both large and small plants. For small plants as well as general cement products plant we recommend the Dunn No. 1 Machine, because it can be easily installed, occupying little space and can be operated successfully and profitably by 1, 2 or 3 men.

For large plants we have the Dunn Automatic, which makes a larger tile and has a larger capacity.

We Want Only Successful Plants. We investigate local conditions for any prospective purchaser. If not right, we advise you not to buy. If right, we go the limit with you. We try to eliminate failures. They are not necessary. We cannot afford that risk any more than you can, as every sale we make is absolutely on our 15 days' free trial offer—your money back if not satisfied.

Write today for this tile book. We send it absolutely free.

W. E. DUNN MFG. CO.

414 24th Street

HOLLAND, MICH.

The Manufacture of Concrete Burial Vaults

A PROFITABLE FULL OR PART-TIME CONCRETE LINE FOR WHICH THERE IS A DEMAND EVERYWHERE.

The World is very sad these days.

La Grippe is at the door.

Many people are dying now.

Who never died before.

"Who never died before." We venture the opinion without fear of contradiction, that of the thousands of people in your city, town or neighborhood who "never died before," will readily express a preference for a concrete burial vault in the preparations for the final disposition of their remains.

The manufacture of concrete burial vaults is somewhat different from the manufacture of other concrete products, building blocks, we will say. With the latter, you first have to find some one who is going to build—perhaps one in ten. In the former, every one is a prospect.

Just at this season of the year many in the cement and concrete working industry are seeking new profitable lines. But a very little consideration is necessary to show the enterprising cement and concrete men, the ready sale and big profits in concrete burial vaults.

It is a perfectly natural desire among people, even an obligation, to afford every measure of protection for their dead. Ample evidence of this desire or obligation is to be found in every cemetery throughout the length and breadth of this country. How strong the desire is, may be judged from the hundreds and hundreds of expensive as well as beautiful mausoleums to be found in almost every cemetery. This desire for the full protection of the dead will continue just so long as love, affection, devotion and sentiment are the impulses that move us all, from the highest to the lowest.

Unfortunately for the great majority of us, the beautiful and expensive mausoleums are beyond our financial reach, no matter how great may be our desire for the protection of our dead.

With the concrete burial vault the condition is quite different. In cost it is readily within our means and while without the outward show as compared with the mausoleum, it assures the same measure of protection as the most expensive tomb or mausoleum ever constructed.

The subject of the protection of the remains of the dead is being given a great deal more attention since the advent of the concrete burial vault than it ever had before. It may be considered fortunate that the great majority of people have no idea of the subterranean influences and conditions which disturb the remains of the dead. Collapsed and flooded graves are not the least of these disturbances. Such conditions are not an unnatural result when the frailty of the usual wooden grave-box is considered. These boxes, none too strong at the outset, rapidly deteriorate when subjected to the moisture of the earth. In the end they collapse from the weight of the earth.

With these obvious results, compare the protection afforded by the concrete burial vault, hermetically sealed, waterproof and with the strength to resist the crushing pressure of the earth.

We see people lavish, and properly so, a great deal of care, attention and money in the up-keep of their burial lots. If the great majority of mourners realized

or appreciated the conditions that too often exist below the surface, there would be no question as to providing concrete burial vaults for the remains of the dead.

To go back to the practical side of the matter, the whole world is really the field for the manufacture of concrete burial vaults. Under these circumstances, it will not be difficult to find a very profitable field right in your city, your town or your neighborhood. This condition is what makes the manufacture of concrete vaults a line which any enterprising cement and concrete man can successfully take up either as a full or part time proposition. No great expenditure is required for equipment and no more than an ordinary knowledge of concrete and concrete work is necessary.

The several manufacturers of concrete burial vault molds operate under several different methods. Some of the manufacturers sell the necessary molds out-right, without restrictions or conditions of any kind. Other manufacturers sell their molds with territorial restrictions. Still other manufacturers merely lease their molds with exclusive territorial rights. Under this latter plan, royalties are paid to the manufacturer on each vault made and sold.

Most concrete burial vault manufacturers work in conjunction with the local undertakers, with a commission on each order. Then again the vault manufacturer sells out-right to the local undertakers who in turn, retail the vaults to their patrons. Obviously, the co-operation of the undertaker is absolutely necessary, since no one, either friends or family, except possibly in the case of a murderer about to be executed, deliberately anticipate in the preparations for burials.

In general the molds are along the same lines of design. The details give them their distinctive features which makes the selection of a mold largely a matter of personal preference. Invariably the molds are of metal, usually steel.

The process of manufacture is extremely simple, closely paralleling any molded concrete work. After the molds are set up, they are lined with the reinforcing material, which in some cases is light reinforcing rods, but more often, heavy galvanized wire fabric or metal lath. After fixing the reinforcing to prevent displacement, the mold is ready to receive the concrete. The mix may vary somewhat with the type of mold used, but as a rule one part Portland cement to one, one and one-half or even two parts of good, clean, sharp sand are the proper proportions. As in all good concrete, thorough mixing is necessary. Sufficient water should be used to bring the mix to a consistency that, when poured, will readily flow into all parts of the molds and completely cover the reinforcing material. After standing for a matter of forty-eight hours or until the concrete has become thoroughly set, the vault may be removed from the molds and left to cure. The cover is cast by much the same operation. In the process of curing, care should be exercised to prevent the concrete drying out too rapidly.

The cost of the materials and labor necessary in the manufacture of a concrete burial vault is very slight, as may be judged from the foregoing description of the process of manufacture. With the several molds now on the market, the cost of production will vary. Five hundred per cent is not an unusual profit.

CORRECT SYSTEM SILOS

Caldwell Silos meet every demand

WHY the constant re-orders from farmers for Caldwell Stave Silos throughout the country?

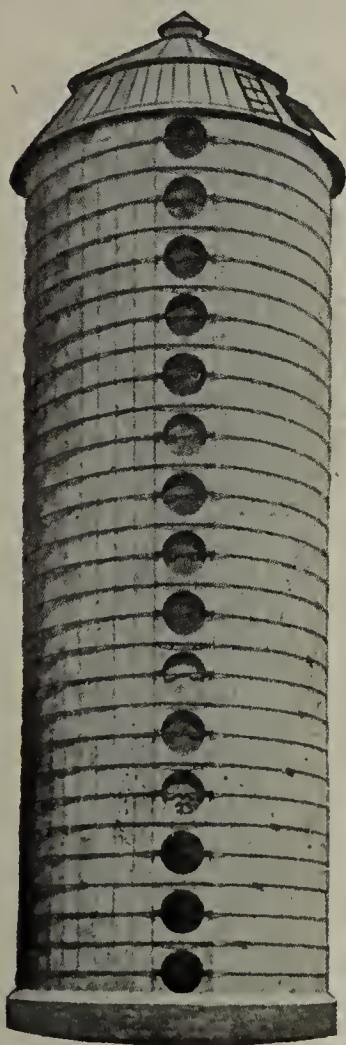
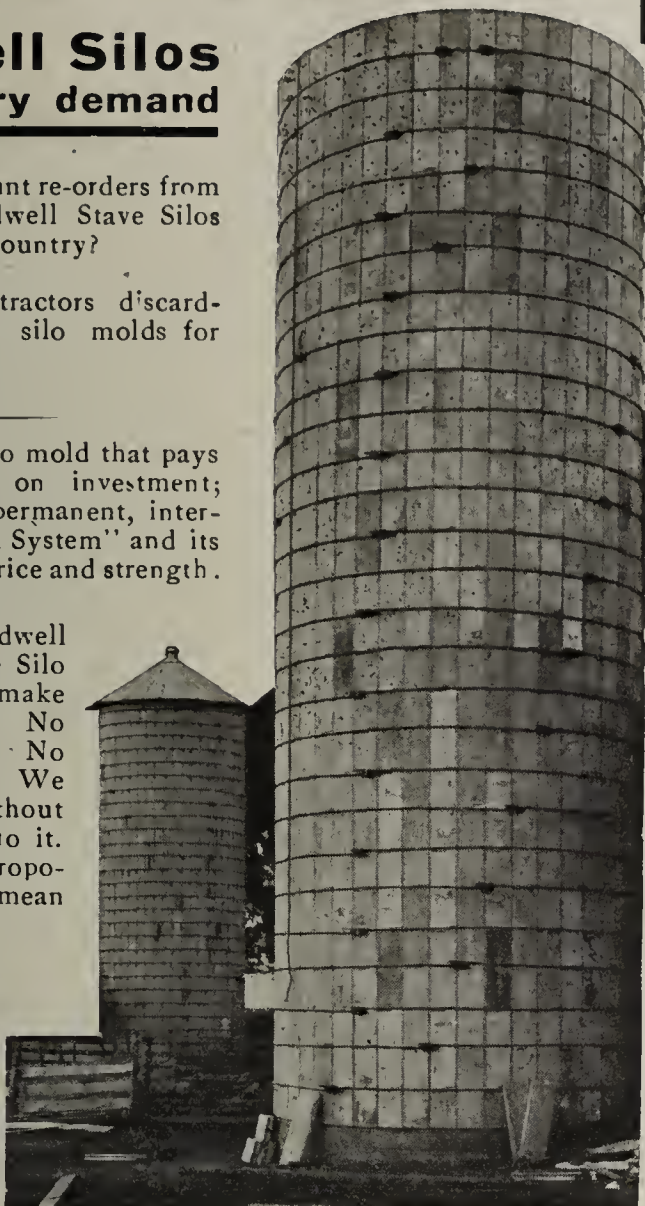
WHY are contractors discarding other stave silo molds for Caldwell's?

BECAUSE it's —

the only stave silo mold that pays large dividends on investment; because of its permanent, interlocking "Correct System" and its simplicity, low price and strength.

Buy a set of Caldwell molds and make Silo Staves as you make building blocks. No royalty to pay. No territory to buy. We sell the outfit without strings attached to it. This is a good proposition and it will mean money to you.

Co-operative
Concrete
Construction Co.
OSKALOOSA, IOWA



YOU will recognize this Cement Stave Silo is built with Pierce Round Steel Doors. These doors are rapidly eliminating wood doors, also spreaders which frame the opening in an ungainly, awkward manner.

ABSOLUTELY FIRE-PROOF.

Simple, effective arrangement provided to fasten rod at door frame.

WRITE FOR DETAILS AND PRICES. It is never too late to improve your silo. No extra equipment required than you are using.

Ask for literature and prices on galvanized roofs, chutes and ladder.

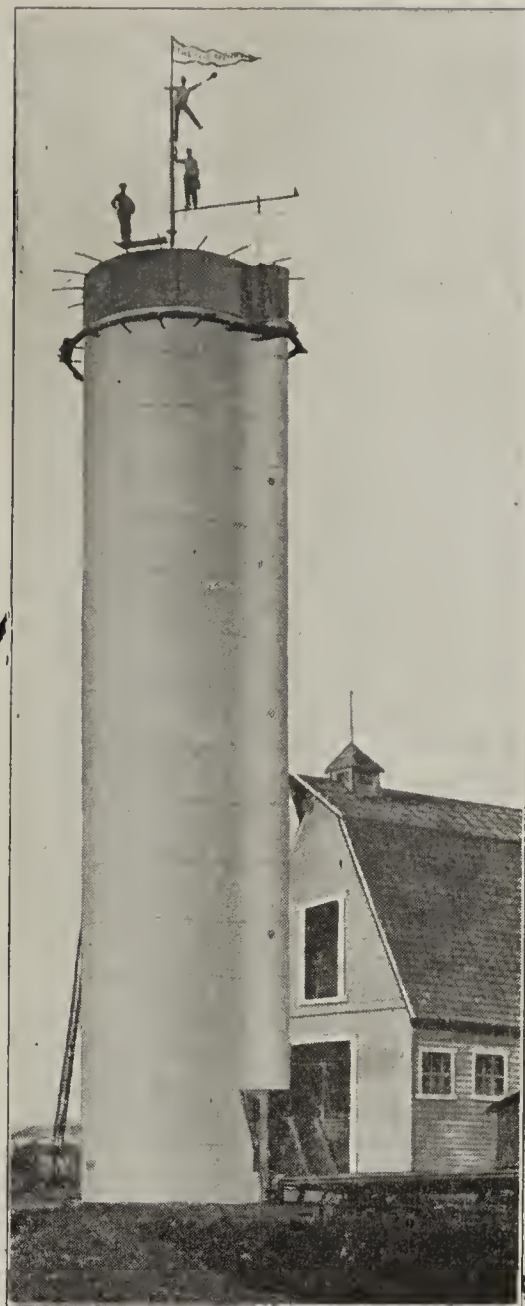
We are largest distributors of silo rods and lugs in the United States.

All inquiries given prompt attention.

THE PIERCE COMPANY
1101 Waldheim Bldg. KANSAS CITY, MO

P

S



MORE MONEY

Concrete contractors are rapidly adopting the POLK SYSTEM of circular monolithic concrete construction. Why? Simply because the POLK SYSTEM machine builds concrete grain storage, coal bins, water towers and silos at high speed and at minimum cost. POLK SYSTEM EQUIPMENT MEANS STEADY WORK, MORE MONEY AND BIGGER JOBS. We have a very attractive proposition for the contractor who wishes to get hold of the paying jobs. Write for it today.

Polk Genung Polk Company
Fort Branch Indiana

2nd Floor, Insurance Exchange Bldg.
175 W. Jackson Blvd. CHICAGO

Fortunately or unfortunately as it may be from whichever position you may be viewing the matter, there is, and always will be, a steady demand for an appropriate and adequate grave receptacle for the remains of the dead. As the concrete burial vault becomes better known, the demand has been very largely increased and has not as yet reached anywhere near the volume that its merits deserve.

In view of the rapidly increasing demand for concrete burial vaults, the large margin of profits, the small original investment and the easy process of manufacture, this represents a line of activity that any enterprising concrete products manufacturer or cement and concrete man can profitably investigate. The local undertakers will, undoubtedly, be able to throw much interesting and valuable light on the possibilities of the proposition. If the undertakers approve and agree to co-operate with you, then it is safe to take up the matter with the manufacturers of vault molds.

The vault mold manufacturers will be able to not only furnish you with the necessary equipment, but give much valuable assistance and suggestions. From that point on, it is but a matter of awaiting the Grim Reaper to do his work and for you to do yours with the resulting increase in your yearly income until at last your turn comes as it inevitably will.

Free Sample

Medusa Waterproofing Paste

A half pound sample can Medusa Waterproofing Paste, sufficient to waterproof 25 pounds of Portland cement, will be sent promptly without charge to any one desiring to investigate the merits of this material. Write the Sandusky Cement Company, Dept. T-5, Cleveland, Ohio, and mention Cement & Engineering News when writing.

If concrete block manufacturers doubt the value of Medusa Waterproofing for their line of work, or want to make better blocks and increase the demand for their product, they should read every word of the following, by Cecil L. Gatten, proprietor of Hills Cement Block Works, Hills, Iowa:

"The Hills Cement Block Works may not as yet make as many blocks as some older concerns, but it does make better blocks than most others. It was in line with the policy of 'quality first' that I investigated the properties of Medusa Waterproofing. I wanted better blocks and to be better they had to be waterproof. Increasing the amount of cement per block made the cost of manufacture prohibitive so was out of the question.

"I consulted three civil engineers of Iowa City, one an authority on cements. The first said, 'The principle is right;' the second, 'Medusa Waterproofing is all right;' the third, 'I am specifying Medusa for the new Iowa River bridge.'

"I sent for a small supply of both Medusa Waterproofing paste and powder and tried it myself. After the first batch was cured and a block containing Medusa Waterproofing placed beside one without, I saw the light and said:—'No more sponge blocks made here.'

"My repeated tests of the identical mixture, with Medusa Waterproofing added, showed a decided gain in density. Local people were skeptical at first until they tried it themselves. One man tested brick with a large blow torch and he was satisfied. Medusa Waterproofing is the only thing that will make a dry-tamped block permanently impervious and useful. Have also used it in poured blocks and find it successful there, too. I prefer the powder form myself for

my equipment but the form don't count, neither does the work.

"Am recommending Medusa Waterproofing every day and planning on increased capacity and larger sales next year."

The swimming pool in City Park, Toledo, Ohio, is 60 by 180 feet, and from one to four feet deep, containing two basins, and is surrounded by a walk 12 feet wide similar bathing pools are located in Navarre and Riverside parks.

These pools were designed by F. E. Wirebaugh, engineer for the Board of Park Commissioners, and Schilinger Bros. Company, Toledo, were the contractors. Medusa Waterproofing was used in walls and floors. The pools were completed three years ago and are in excellent condition and no leaks have developed,—more conclusive evidence of the wonderful waterproofing qualities of Medusa Waterproofing, which is being used extensively in other public work in Toledo.

An Improved Material Elevator

Have You a "Little General" on the Job?

The big question in the contracting field is how to lessen labor costs. Profits are raised when costs are decreased, and every contractor owes it to his business to apply those methods which help boost the bank balance.

There has been ample room for improvement in the methods of hoisting material. The plodding hod carrier never figured as an investment—he represented a mighty big expense, and a mighty slow method. And what was true in carrying brick applied equally to getting other material from the ground to where it was needed.

So—exit the hod carrier and enter the "Little General" Elevator! It sounds big to state the "Little General" will save 25% of time and labor in erecting a



building, but actual use has proved the statement true. It will easily keep from twelve to fifteen bricklayers supplied with material, and the same economy applies to concrete construction. Whatever material requires to be elevated can go via the "Little General" route quicker, and with less expense, than any other method known.

A contractor can dispense with several laborers directly the "Little General" comes on the job. This explains how its cost is completely saved after being used on two or three contracts. It is easily and quickly erected, and is equally simple to take down, move or store. A "Little General" outfit includes carts of a new type, which are built for quick and easy operation.

We understand the "Little General" is furnished on a thirty days' trial. Full information can be obtained by writing the H. B. Sackett Co., 1679 Elston avenue, Chicago.

The Roof for All Time

Start a
"Concretile"
Plant



The Greatest
Opportunity in the
Construction Field

The most economical, attractive, permanent fireproof roofing in existence. A standard roofing in Germany for more than 25 years.

The manufacture of Walter Concretile is now a national industry in this country. Within the last eighteen months large plants have been established in many of the leading cities. All operating plants have business booked ahead—the demand is universal.

We Do Not Sell Blue Sky

We sell complete equipment for starting business. We protect you in the territory by establishing only one plant in a locality.

Send today for free booklet giving full information.

Walter Concrete Machinery Company

418 Saks Building

State Representatives Wanted

Indianapolis, Ind., U. S. A.

The Multiplex Double Stripper Block Machine makes two Hollow Plain or Rock Faced Block of Wet Mixture at ONE OPERATION



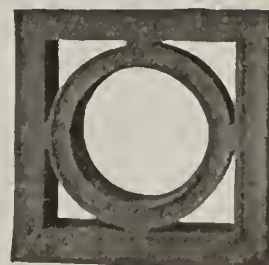
Here is a machine that cuts down the cost of making your building block. In making plain faced block the machine handles a wet mixture and stripping the block out it trowels the sides. The wet mixture compacted under pressure from *both top and bottom*, produces a strong waterproof block which is easily cured. A 150-lb. man on the end of the lever will exert a 40-ton pressure on the block. Two men will make from 700 to 800 blocks per day on this machine.

Write for our latest printed matter explaining the operation of this labor-saving machine in detail

Write for catalog No. 10 and mention Cement News
The Multiplex Concrete Machinery Co., Elmore, Ohio

Same Machine Makes Chimney Block

The Multiplex Stripper may be equipped for manufacturing chimney block as well as building block. Note the flue block shown here with the round smoke chamber in the center, the ventilating chambers in the corners and the tongue and groove joints insuring rigid construction. There is money in the manufacture of chimney blocks alone.



Loading Rock by Auto Crane

An interesting method of loading rock is employed by A. Courchesne of El Paso, Tex., at his limestone quarries near that city. The stone is broken out by means of two large tripod drills and three jackhammer drills, all operated by compressed air. The pieces of rock are piled into skips and are elevated and dumped by means of a Byers auto crane, manufactured by the John F. Byers Machine Co., 260 Sycamore street, Ravenna, Ohio, into motor trucks and wagons for haulage to the crushing plant, $\frac{1}{4}$ mile distant.

In all 15 skips, each of $1\frac{1}{2}$ tons capacity, are used.

famous Hyatt Flexible Roller Bearings and with sectional chute for fast distribution. Drum is placed high—with 34 degrees pitch on the chute. Two way traction is provided with crucible steel traction gears and simple, powerful differential clutches on the traction shafts. Novo or Ideal frost and dust-proof gasoline or kerosene engines furnish power and all operating levers are within easy reach of the operator.

Boss Gas or Kerosene Power Pavers are made in 8, 11 and 15 ft. sizes—all completely equipped with all modern improvements. The 11 and 15 ft. sizes are also furnished with steam power if desired and all three are equipped for electric motor drive.



Byers Auto Crane Loading Rock at Quarries Near El Paso, Tex.

In this way there always is a supply of rock ready for loading. The hauling is done by two $3\frac{1}{2}$ -ton Standard motor trucks and three 3-ton back dump wagons. The hauling cost per ton by motor truck is 4 ct. and by dump wagon 7 ct. The loading cost with the Byers auto crane is 2 ct. per ton. The outfit has a capacity of 500 tons per day.

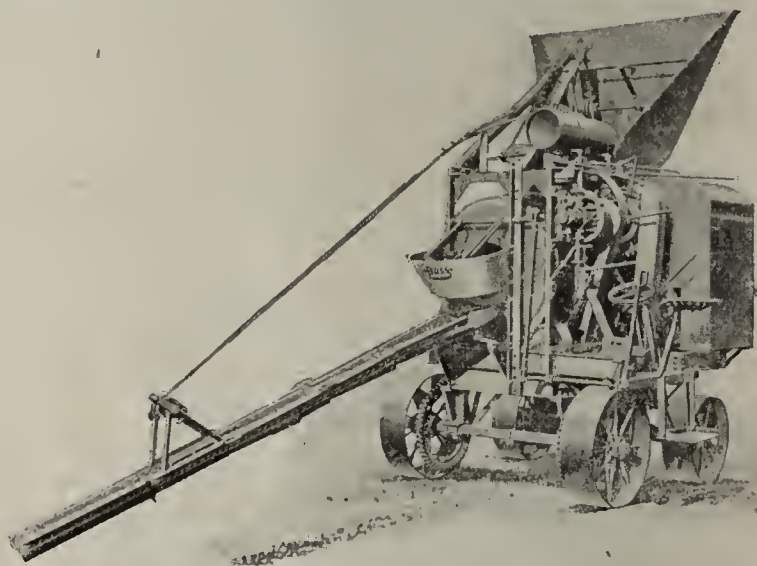
The American Cement Machine Co. will gladly furnish anyone interested with complete information about their line of pavers. Address them at Keokuk, Iowa, and ask for their 1917 catalog.

Gasoline-Kerosene Power Pavers a Big Economy

The adaptation of internal combustion engines, using gasoline or kerosene as fuel, to use as power producers for paving mixers has made possible an economy of mixer operation entirely impossible with the older type of steam-driven pavers. The lower cost of power delivered to the mixer cuts costs and increases profits materially and the reliability of properly designed and constructed gasoline or kerosene engines for this service is no longer questioned by anybody.

The American Cement Machine Co., Inc., of Keokuk, Iowa, manufacturers of the Boss complete line of concrete mixers—have specialized on gas and kerosene power pavers and are now offering mixers of this type which appeal strongly to paving contractors everywhere. They are known as the "Lincoln Highway" type pavers and have the advantages of being, according to the makers, the lightest and most economically operated pavers made today. They can be operated at a saving of \$5.00 per day over steam pavers—cost of fuel usually being not greater than \$1.00 per day's run and no licensed engineer or fireman being needed to handle them. An ordinarily intelligent man at laborer's wages can handle the outfit perfectly and only *one* man is necessary.

These pavers have many special features of interest. They are built of steel—are practically 30 per cent stronger than old type cast iron pavers—and are from 2,000 to 4,500 lbs. lighter. They are equipped with the



Lincoln Highway Type Paver.

Saves More Potash

It is reported that a German chemist employed by the Security Cement and Lime Company, at Security, Md., has discovered a new method for increasing the production of potash from certain cement rocks. The process uses common salt, which is mixed with the raw materials and liberates a greater quantity of potash than the ordinary process, and makes its recovery easier. Approximately two and a half tons of pure potash are saved daily by the process which, at the prevailing rate of \$500 per ton, makes the process a valuable one.

The present plan for the recovery of potash is the result of experiments carried on by California plants, but until the discovery of the salt process, the saving of potash was not nearly as great.

Concrete for Railroad Ashpits

The report on masonry of the American Railway Engineering Association calls attention to the severe usage given ashpits and their attendant cost of maintenance. To keep the cost down, a great deal of care should be given to the design. The report further says:

The usual procedure at an ashpit is to drop or wash the hot ashes into the pit, and this heats up the walls and other parts of the structure. Then cold water is thrown on the ashes to cool them. The rapid cooling causes contraction in the material and when repeated many times weakens and sometimes destroys the structure.

Another destructive element is the sulphuric acid pro-

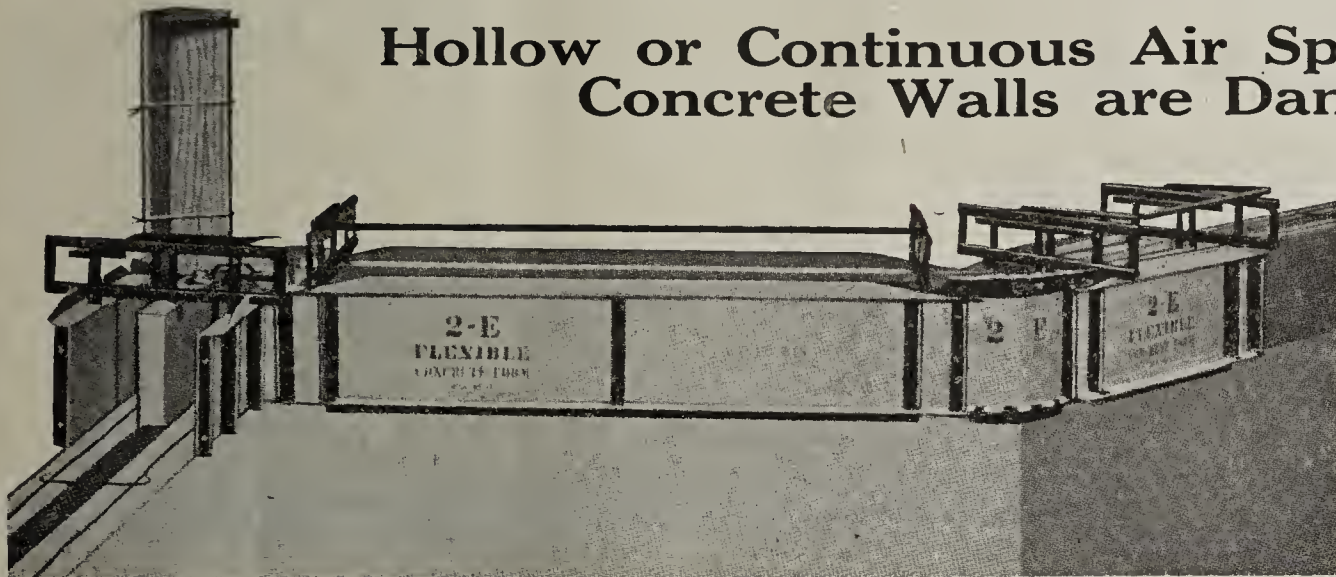
duced by the water and sulphur in the ashes. This destroys the steel parts (coming in contact with it) at a rapid rate.

Most ashpits are built of concrete, in which limestone is a principal ingredient. Hot ashes cause this limestone to swell and disintegrate, and in a short time the concrete will begin to spall off.

Vitrified brick facing has been used, but on account of the nature of the work and the tools used, experience shows that it is soon knocked off.

Slag and gravel concrete has been used in place of limestone concrete and makes a good substitute. If trap rock is available, it makes a better concrete than either of the above materials.

Hollow or Continuous Air Space Monolithic Concrete Walls are Damp Proof



2-E Equipment

makes possible the construction of concrete homes that are absolutely fire and damp-proof, at a cost not to exceed wood construction.

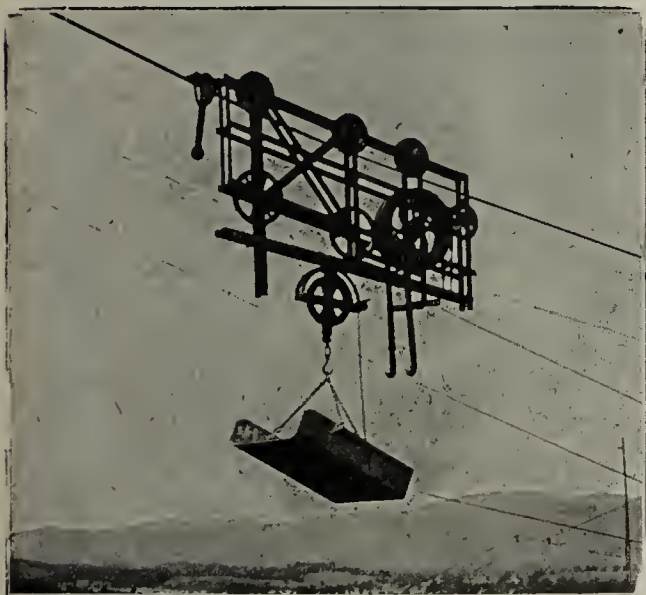
Send for our free trial offer.

2-E Flexible Concrete Forms

692 Centre St., EAGLE, WISCONSIN

The Rugged Ruggles

AERIAL CARRIER



Suspended over Slate Quarry

SELF DUMP BRAKE LOCKING

Built in Two Sizes:—1 to 5 tons capacity, 5 to 10 tons capacity.

The **Rugged Ruggles** is made for special use on cement and gravel construction work. For all kinds of quarries where the waste is taken from the pit and dumped at the surface. It will take any load up to ten tons, from any depth to the cable, where it is automatically released and sent either up or down the cable and dumped in mid-air or lowered. One man can operate three **Rugged Ruggles** on as many cables with a three-drum engine:

No brake to wear the cable—Can run on a flat cable.

Simple in construction; made entirely of steel; all the sheaves steel bushed or brass, and is backed by years of extensive use.

Manufactured by

Ruggles Machine Co., POULTNEY VERMONT Dept. C

Bulldog Construction Throughout

Digs on both sides and better than any bucket of the same weight

Our aim is to build a better bucket, knowing that in the long run, everything else being equal, the user will try the bucket that stands up.



It Speaks for Itself
Send for Bulletin

THE RUDDOCK BUCKET CO.

1501-1513 University Road, Cleveland, Ohio

Do You Understand Dairy Barn Cement Work?



Write for Loudon Book of Barn Plans and "STANDARDIZED MANGERS." They are full of practical, money-saving information every cement worker needs.

Louden Barn Plans is a 112-page book containing over fifty plans for barns and much construction information. It is free to any contractor who will ask for it.

Floor and manger construction for dairy and general purpose barns is a distinct branch of the cement worker's trade, and requires special knowledge. You must understand not only floor, manger, and gutter designs, and the purpose for which each is best adapted, but also the most practical method of erecting modern barn equipment. In the modern dairy barn the erection of steel stalls, stanchions and pens is inseparably linked with the cement work. Loudon's "STANDARDIZED MANGERS AND DIRECTION SHEET" contains all the information necessary to enable you to do the cement work in any barn. Drop us a card today. Simply say, "send me your cement work literature," and it will be mailed promptly.

Cement Workers Wanted

We want cement workers everywhere to install Loudon Dairy Barn Equipment. Write us for further particulars.

The Loudon Machinery Company
5902 Court Street
FAIRFIELD, IOWA

Concrete Plants, Contractors, Etc.

Secure our confidential processes, methods and formulas and make concrete marble granites, sanitary flooring, etc., and make money.

Write for details

ART STONE CO.

Box 330

Waynesboro, Pa.

Big Profits

Making Vaults

Easy to make, and easy to sell.

Automatic Sealing Vaults assure big profits and steady work.

You can make these vaults in your spare time, or start a business of your own. The only equipment necessary is a set of our Adjustable Steel Molds.

The Automatic Sealing Vault automatically seals itself when the cover is put on; and protects a burial casket forever against water, vermin, and decay. It is cheap enough for everyone and appeals to everyone.

Write for full information.

The Automatic Sealing Vault Company
216 E. River St. Peru, Indiana



CONCRETE PORCHES



**ATTRACTIVE
EVERLASTING
INEXPENSIVE
EASY SELLING**

Made with Dunn Molds

Concrete porches are always in demand; pay a big profit to contractors. An outfit of Dunn Porch Molds will make all blocks shown in illustration. Same blocks will also build Chimneys, Posts, Piers, Ornamental Fences, etc. Entire outfit costs very little. Write for Ornamental Mold bulletin.

W. E. Dunn Mfg. Co.
414 24th St., Holland, Mich.

MOLDS SOLD ON 15 DAYS' TRIAL.

Pebbles for Tube Mill Grinding

Specially Selected for Cement Manufacturers
PRICES QUOTED ON APPLICATION

ENCINITAS PEBBLE COMPANY

ENCINITAS, CAL.

BELTING

"VICTOR" Balata
"AMPERE"
(Canvas Stitched)
"WHITE SEAL"

Write for Prices, Discounts and Samples

VICTOR BALATA & TEXTILE BELTING CO.

Easton, Pa., and 38 Murray St., New York, or 167 N. Market St., Chicago, Ill., and 87 High St., Boston, Mass.

CONVEYOR BELTS A SPECIALTY

Cement and Engineering News

Vol. 29

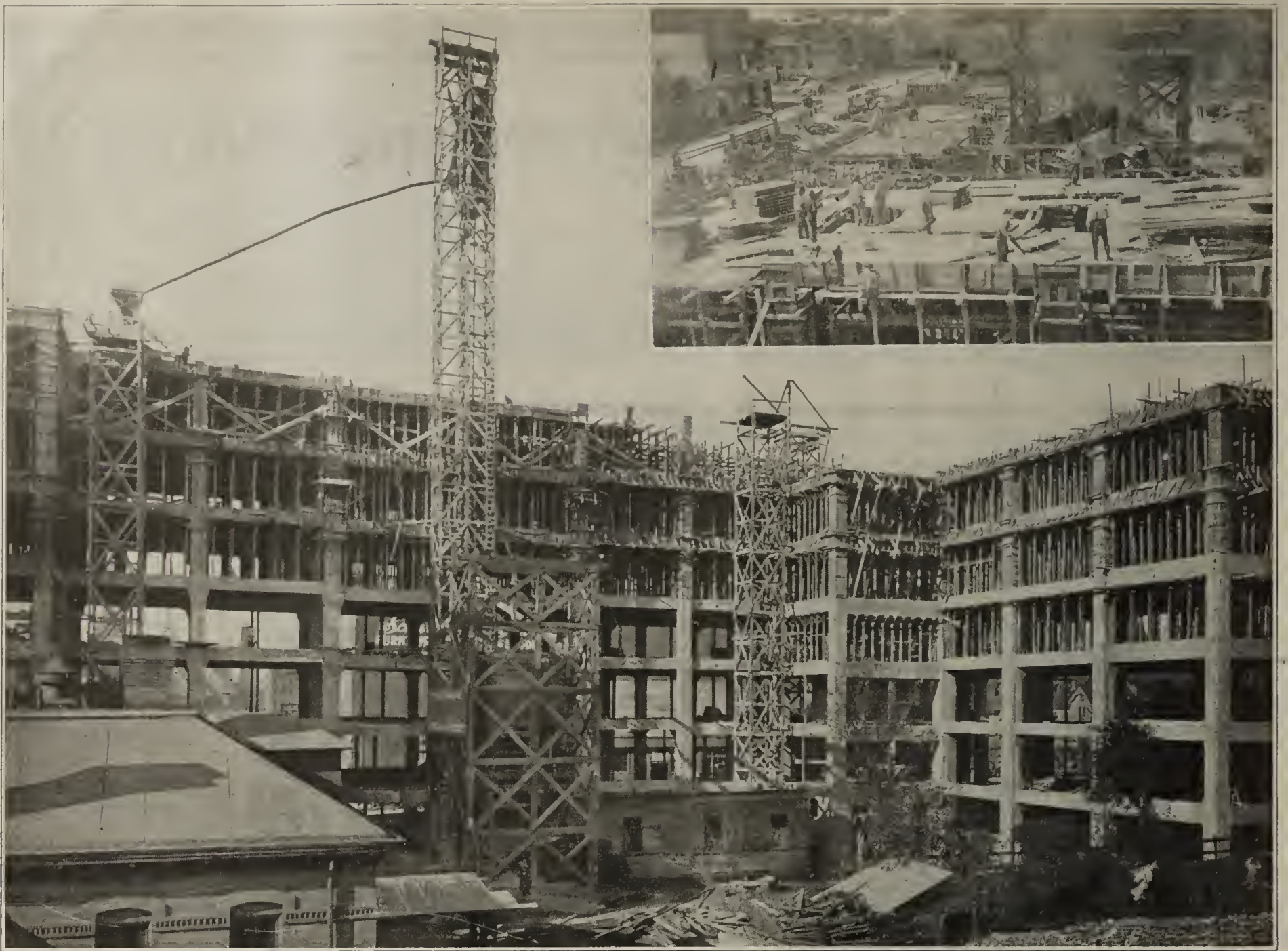
June 1917

No. 6



California Terraced Gardens Beautified by the Use of Medusa White Cement.

The gardens of G. W. Wattles, Hollywood, California, illustrated here, are the design of Elmer Grey, Los Angeles, one of the most noted architects of the Pacific Coast. It is one of the few terraced gardens that is terraced upwards from the house instead of vice versa. A great gash or hole was cut in the hill back of the house in order to accomplish this terracing, but the disfigurement to the landscape occasioned thereby was completely obliterated and restified by the system of walls, steps and terraces built of cement and by the planting.



Rear of Foote-Schulze Reinforced Shoe Factory, Showing Main Hoist and Two Distributing Towers. Panel Shows Panel Forms for Floor Slab.

Fast Concreting in Building Construction

Good Plant Arrangement Gives a Record for Rapid Placing of Concrete in St. Paul Building

BY J. C. WORRELL.
Civil Engineer, Excelsior, Minn.

The new Foot-Schulze building, located in St. Paul on Robert street between Ninth and Tenth streets, was built for the Foot-Schulze Shoe Co. by the George J. Grant Construction Co. of St. Paul. It is a seven-story and basement reinforced concrete structure which has a total floor area of over 200,000 square feet and which cost about \$500,000. Considering the number of men employed and the actual working time, the contractor has made a record in speed of construction.

Each story contains about 1,200 cubic yards of concrete. The record was made on the fourth floor, where 390 cubic yards of concrete were poured in 10 hours. The output record for the whole job is given by the series of floor diagrams shown. All concrete was mixed 1:2:4. About 21,000 barrels of cement, furnished by the St. Paul Builders' Material Company were used.

The excavation was started on June 6, 1916, with steam shovels, and the progress was good, considering the amount of solid sandstone which had to be removed. The record was made later in pouring concrete for the columns and floor slabs. The footing of the columns and some of the basement walls were put in with a portable mixer while the main mixing plant

was being constructed. The main concrete mixing plant probably cost more than any ever put up in the Twin Cities, but it was so well arranged that more concrete was handled in a given time than has ever been done in building work before.

Concreting Plant

Mr. K. P. Grant made some improvements on the system (originally designed by Butler Bros. of St. Paul) used in lifting the crushed stone and sand into the storage bins located above the mixer. The crushed stone and sand were hauled to the job by Pierce-Arrow motor trucks of about 8 tons capacity and Streich dump wagons of about 5 tons capacity, and dumped on a lifting platform about 8x14 feet. The platform was raised through the tower up to the storage bins by means of eight double blocks, and cables which were attached to a hoisting engine for that purpose only. The four blocks on either side of the platform were handled by separate drums on the hoisting engine so that the back end of the platform could be raised higher than the front end to slide the material into the storage bins.

The measuring bins below the big bins were so arranged that one man by means of levers dumped the crushed stone and sand into the mixer. Cement was taken from a store house near the mixer and emptied directly into the mixer. A 1 cubic yard Austin drum mixer discharged into a bucket which was hoisted through a tower by another engine to a storage hopper. This hopper discharged into a chute which carried the concrete to other storage hoppers. There was a tower near each end of the building which carried the lower storage hoppers, and these towers were raised as the work progressed to the upper floors.

The concrete was handled from the lower storage hoppers in two-wheeled carts, which were operated on runways about 4 feet wide. The runways rested on wooden horses, which raised them above the finished floor. As the different sections of the floor were finished, the runways were carried back out of the way and the concrete was leveled with a long, straight edge, which was pulled along on small angle irons, called screeds, clamped to iron pins driven in the floor. The pins and screeds were removed before the surface was smoothed.

The old system of putting a 1 to 1½-inch finishing coat on the floors after the building is nearly completed was not followed here. After the concrete had hardened sufficiently, equal parts of sand and cement, mixed dry, were sprinkled over the concrete and floated on the surface, and shortly after Ironite floor hardening material, mixed with equal parts of cement, was sprinkled on the surface, which had been floated. This material was thoroughly worked so that it made a hard and smooth surface, and the whole floor was a homogeneous mass. The Ironite floor hardening material is very finely ground iron and it makes the surface so hard that it is practically dustless. This finished floor was covered the next day with one thickness of building paper, and sand about 2 inches thick, so that it would not be scratched in placing the falsework for the floor above.

Form Construction

The cost of form building was reduced by a method which is probably new to most contractors. The concrete forms for the walls in the basement and the different floors were made into panels 4x6 feet. These panels in the floors rested on 4x6-inch posts, spaced 4 feet apart. They were made of inch lumber securely nailed to 2x4-inch pieces spaced 12 inches apart. The use of the panels increased the speed of laying the floor and it reduces the breaking of lumber when removing the forms to a minimum. The panels were used several times in the construction of this building and are still in good shape to be used on other concrete construction.

Handling Other Materials

All materials except the concrete aggregate was delivered on the street and hoisted as needed by two small derricks built on towers just outside the building. The towers were located at either end of the building and were about 250 feet apart.

Probably few readers of construction work realize the number of patented articles required in the building of a structure like this one. The following is a list used in this building: 5 hoisting engines, 4 gasoline engines, 2 concrete mixers, dump wagons, 3 auto trucks, 2 power iron saws, reinforcing bars, efficiency spacers for reinforcing bars, square column clamps, steel form molds for round concrete columns, concrete buckets, concrete chute, concrete storage hoppers, derricks, Ironite floor hardener, wire tighteners for concrete forms, Medusa concrete waterproofing paste, flat slab system of floor design, inserts for hanging motors and shafting to run machinery, U. S. Steel window sash, electric machinery, electric lights, telephone,

freight and passenger elevators, automatic sprinklers, window washer hangers, scuppers and scaffold hangers used for bricklayers' scaffold.

Contractors

The new Foot-Schulze building is one of the largest reinforced concrete structures put up by the George J. Grant Construction Company, and it adds another monument to the many others which this contractor has built in St. Paul. Mr. W. F. Drifke was superintendent for the contractor. Kees & Colburn of Minneapolis were the architects and E. R. Evans was superintendent for the architects; the W. J. Kalman Company of St. Paul designed the reinforcement; C. L. Pillsbury, of Minneapolis, was the consulting engineer for the mechanical equipment.

Colored Aggregate Stucco

After nearly a year of experimenting, the Atlas Technical Department of the Atlas Portland Cement Co. has announced a new step forward in home construction, namely, unusual color tones in stucco, secured by the use of aggregates of beautiful colors, such as pink marble and granite screenings, yellow granite screenings and gravel, light red and green marble screenings, colored sands, etc. These color tones, instead of being uniform or monotonous, are variegated or checkered and have unusual warmth and individuality. The quantity of these aggregates required in the finish coat is approximately two cubic yards for the average size home. Therefore, the cost is insignificant, whether you secure the aggregates from nearby deposits or have them shipped from a distance.

Advertising in Color

This new development in home construction will be actively promoted throughout the year in full-color, attention-getting advertisements to both the general public and architects.

To reach the public, the best known national magazines have been chosen, with a circulation of nearly 2,000,000 families. You will note that we have placed the emphasis on home building instead of on cement, writes the Atlas cement company. We feel sure you will agree that this advertising will create great interest in home building and colored stucco—and, therefore, will mean more work for contractors who look into the possibilities of colored stucco.

To acquaint the architects with this new development, a complete campaign in both full color and black and white will be used in their leading publications, with a combined monthly circulation of 20,840 copies. This new stucco will be of special interest to architects, because it increases their opportunities for beautiful, artistic effects in home construction.

A Book for You

A number of the test panels have been reproduced in full scale and color, together with formulas, in a new book, "Color Tones in Stucco." This book describes how the results were attained, tells where colored aggregates can be secured, and contains specifications and notes on color stucco construction. A copy will be mailed to you on request—write Atlas Portland Cement Company, 30 Broad street, New York, N. Y., for a copy.

Standard Sizes of Concrete Mixer

Standard sizes recently adopted by the National Association of Mixer Manufacturers provide for side loading concrete mixing machines with capacities of 4, 7, 14, 21, or 28 cubic feet each, and for end loading or paving mixing machines with capacities of 7, 10, 14, or 21 cubic feet each.

Design and Construction Details of a Long Concrete Arch Bridge

BY C. D. HALE

SYNOPSIS—Describes the general design and the details of construction of a bridge with eight arches of 52- to 88-ft. span. Concrete handled in dump-cars and sometimes placed during severe weather. Interesting notes as to temperature changes in the fresh concrete.

The Morgan street reinforced-concrete arch bridge across the Rock river at Rockford, Ill., will be completed this spring. It takes the place of an old wood-truss bridge. The new bridge will be 965½ feet long over all, with a continuous grade of 3 per cent rising from the west end. The main portion comprises eight arch spans—three of 52-foot clear span, one of 79 feet and four of 88 feet. Each span has two arch ribs 4 feet wide, spaced 22 feet apart. The bridge is 44 feet 8 inches wide over all, with a 28-foot roadway and two 7-foot sidewalks. The latter are carried on canti-

included, the unit stress is taken at 800 pounds for compression in concrete and 20,000 pounds for tension in steel. Latticed steel ribs are used in the arch ribs.

The concrete is made with local gravel. A 1:3:5 mix is used for the footings and piers up to the springing line, above which it is 1:2:4 for all the work, except that for the hand railing the mix is 1:1½:3. The washed sand, supplied by the Rockford Sand and Gravel Co., was of the following sizes: 2 to ¼ inch for abutments and retaining walls; 3 to ¼ inch for footings; 2½ to ¼ inch for piers up to sprinkling line; 1¼ to ¼ inch for all parts above springing, except ¾ to ¼ inch for the hand railings, parapets and lamp posts.

The roadway slab is 7 inches thick and has a crown of 6 inches. On this will be a 1-inch sand cushion for brick paving laid with tar filler. Expansion joints are provided at the sides of each pier, with three thicknesses of tar paper in both the vertical and horizontal surfaces of the joint. The exposed surfaces of the

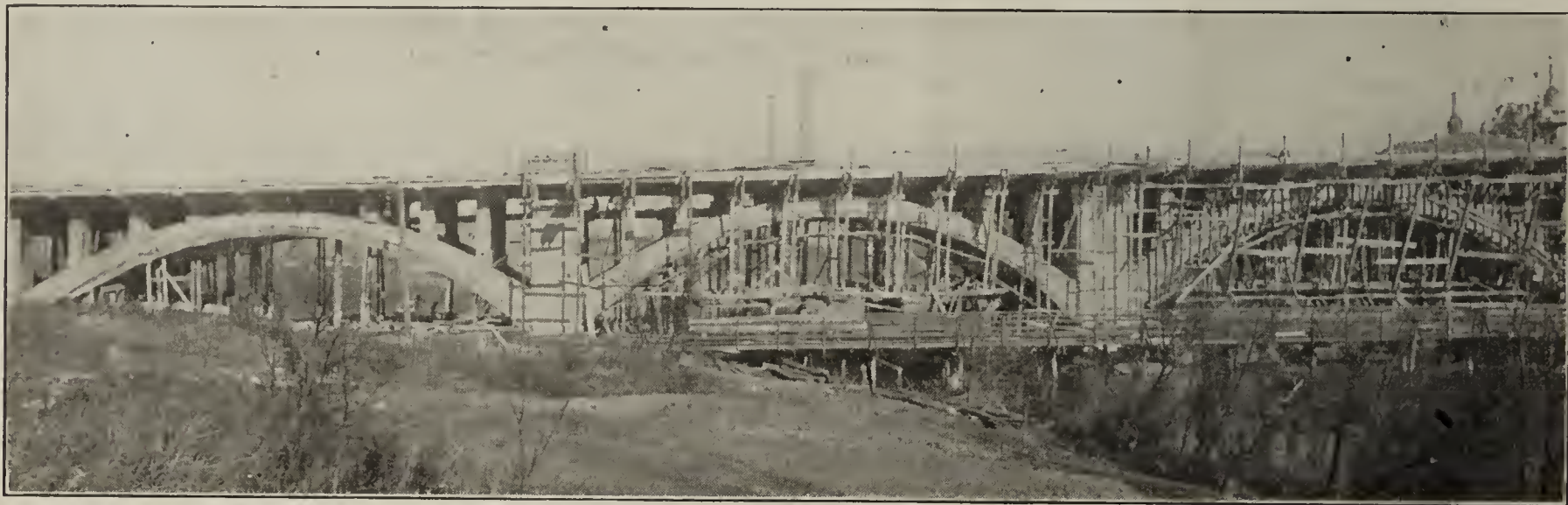


Fig. 1. Construction of Morgan Street Reinforced Concrete Bridge, Rockford, Ill.

lever brackets extending out from the spandrel columns. Fig. 1 is a view of three spans at the east end, and Fig. 2 shows the cross-section.

The west approach is a fill 181 feet long, with retaining walls, followed by a 28-foot concrete girder span. At the east end are two similar girder spans over the Chicago, Milwaukee & St. Paul Ry. The west abutment and the first two piers are on sandy clay, with no piles. The other piers and the last abutment are on gravelly soil, with pile foundations.

Design, Concrete and Details

In designing the structure the dead-load is taken at 150 pounds per cubic foot for concrete and 120 pounds for earth-filling. The bridge is designed to carry a uniform live-load of 150 pounds per square foot of roadway and 100 pounds per square foot of sidewalk or a concentrated live-load consisting of a 24-ton traction engine with 16 tons on the front axle and load distributed according to the specifications of the Illinois Highway Commission. The design provides also for a temperature range of 80° F.

The following unit stresses were used: Concrete, 650 pounds per square inch in compression; steel, 16,000 pounds per square inch in tension, and in compression 15 times the unit stress in the surrounding concrete. For the arch ribs, with temperature stresses

concrete were not treated in any way, the form marks being allowed to remain. The parapet, or hand railing, is of special design and is poured in place in pressed-steel forms that can be used many times. The bridge will be lighted by 22 electric lamps mounted on ornamental concrete posts on the hand railing.

Construction Methods and Plant

The construction plant consisted of one stiff-leg derrick operated by a double friction-drum hoisting engine; one 3-ton hand-operated stiff-leg derrick; a steam-driven Austin cube concrete mixer of 11 cubic feet capacity; a Jaeger gasoline-driven mixer, used to pour the hand rails; four steel dump-cars of 21 cubic feet capacity; one single friction-drum hoisting engine, and two 6-inch centrifugal pumps, together with wheelbarrows, drop hammers, piledriver leads, etc. A side-track of the Illinois Central railroad crosses Morgan street about 50 feet from the west end of the bridge. Therefore the cement shed and office were placed here, and all materials were unloaded at this place.

The steam-driven mixer was placed at the west end of the bridge and a track of 24-inch gage was laid over the old bridge. The cars were operated by a cable from the single-drum hoisting engine placed at the east end of the track. The sand and gravel were wheeled to the mixer in barrows. From the mixer the

concrete was hauled up in steel dump cars by the engine and dumped into chutes placed wherever concreting was in progress. A switch was placed at the mixer, and two trains of two cars each were operated.

The work started on the retaining-wall section; and as it progressed, the old bridge was torn down and the track relaid over the completed spans of the new structure. This process was followed until four spans of the new bridge were in place. Then the mixer was moved to the east end of the fourth span and the aggregate was hauled by team and spread over the floor of the new bridge in shallow piles. From these it was wheeled to the mixer, whence it was chuted directly into the forms of the next pier and arches. In pouring the roadway and sidewalks of the next span it was necessary to haul the concrete to place in the small cars. When this span was finished, the mixer was again moved to the end of the completed work and this process repeated for each of the remaining spans.

All the reinforcing steel was bent by hand on a bench in the steel yard and delivered to the forms ready to place. The latticed steel arches used to reinforce the arch ribs came in sections weighing about 1,000 pounds each. They were lifted into place by the hand derrick, which was carried overhead on the falsework. This derrick was also used in placing the heavy timbers of the falsework shown in Figs. 2 and 3.

The arches of span No. 8 and the east abutment were poured in rather severe weather. At various places in the concrete were placed pieces of tin speaking tube, in which thermometers were inserted for the purpose of taking the internal temperatures. Unfortunately, no systematic record of these temperatures was kept, but it was noticed that the temperature increased from about 65° F. (at which temperature the concrete was placed) for about three days until it reached a tem-

perature of 88° F. It kept this latter temperature for about 48 hours despite the fact that atmospheric temperatures ranged from 5° to 35° above zero during this time.

As the excavation proceeded, the material kept getting finer. It changed from a coarse gravel at the top to a clayey sand at the bottom. This fine material gave considerable trouble by boiling up under the sheeting and in the bottom of the dam and washing in the puddle walls, although the inner sheeting was driven 5 or 6 feet below the excavation. This trouble was remedied by sand bags placed around the inner sheeting in the bottom of the puddle wall.

All the falsework piles were driven from the floor of the old bridge. After these were in place, the derrick was lowered to the stone pier at the east end of the old bridge and moved back over the falsework piles for the purpose of wrecking the old bridge. This was done with the aid of an oxyacetylene torch, which was used to cut the steel tie-rods and hangers. When the old bridge was closed to pedestrians, a pile foot-bridge was built, as shown in Fig. 1.

The bridge was designed by the Westcott Engineering Co., of Chicago, in conjunction with J. B. Marsh, consulting engineer, of Des Moines, Iowa. It is being built under the direction of Edwin Main, city engineer of Rockford. The cost will be about \$83,500. The John J. O'Heron Construction Co., of Chicago, has the contract for the entire work. Alexander Cross is superintendent in charge for the contractor.

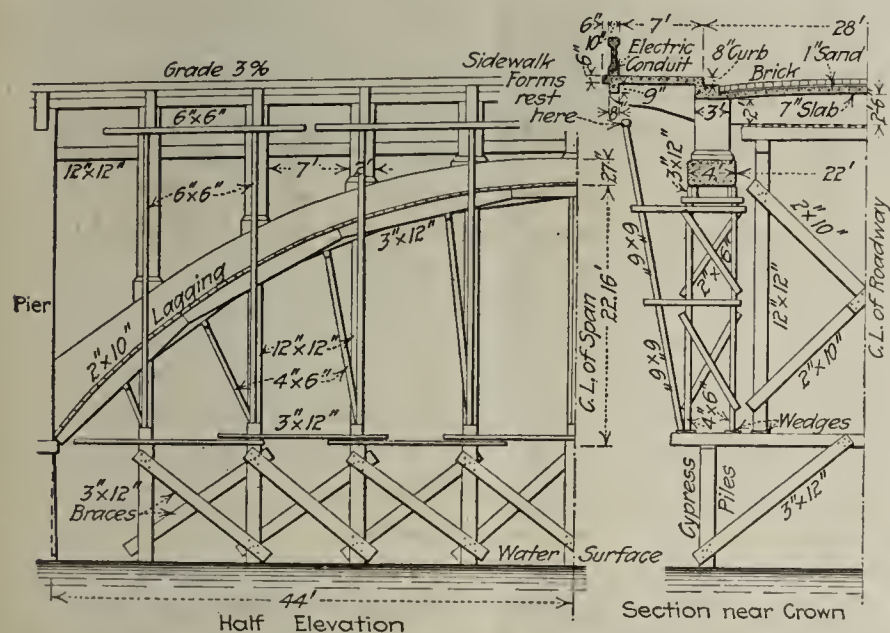


Fig. 2. Arch Centering and Falsework for the Rockwell Bridge. perature of 88° F. It kept this latter temperature for about 48 hours despite the fact that atmospheric temperatures ranged from 5° to 35° above zero during this time.

Only three piers of the bridge (Nos. 5, 6 and 7) were placed in the stream, the depths of water being respectively 5 feet, 15 feet and 11 feet. At piers 6 and 7 the excavation was carried down 6 feet and 8 feet below the bottom of the stream. This was accomplished by the use of puddle-wall cofferdams, using 3x8-inch tongue and grooved sheeting 28 feet long. The cofferdams were 16x39 feet inside, with a 4-foot puddle wall.

When the cofferdam for pier 6 was placed, it was found that about 3 feet of riprap boulders, used to protect the foundation of the old stone pier (which stood alongside the new one) had to be penetrated results of their use will be absolutely plumb and true.

Cement Plant To Be Electrified

The Lawrence Portland Cement Company at Siegfried, Pa., of which Ernest R. Ackerman of Plainfield, N. J., is president, is electrifying its plant at an estimated cost of \$250,000, and will get the power from the Lehigh Navigation Electric Company's power plant at Hanto, Pa. Up to this time the company has utilized steam for the 4500-horsepower necessary to run the plant, which produces from 5000 to 6000 barrels of cement a day. Electrification was determined upon as a matter of greater output, flexibility and economy. Flexibility will be given through the fact that virtually every machine will have an individual motor. The company itself is doing most of the work of installing the motors and other electric machinery, under the direction of Superintendent Charles A. Porter, who is also a vice-president of the company.

Concrete in Special Forms and Colors

The Ideal Concrete Machinery Co., 1353 Monmouth avenue, Cincinnati, Ohio, has issued catalogue No. 30, which is devoted to Ideal ornamental and special moulds for making various forms of concrete for balusters, lattice work, benches, posts, columns, balls, vases, urns, etc. Catalogue No. 29 is illustrated and descriptive of the Ideal brick machines, and a leaflet also shows the Tycrete colors, which are employed to secure beautiful effects in red, white and green. The company guarantees that its moulds are held in perfect alignment by its locking and squaring device and that the

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Advertising Rates Sent on Application

JOHN F. WALDRON

Advertising Manager

CHICAGO, JUNE, 1917

Cement Manufacturer Making Potash With Cement as a By Product

In the attempts of the United States to find some methods of increasing the potash production for fertilizers and other purposes to offset the stoppage of shipments from Germany there has come to the attention of the Bureau of Mines, Department of the Interior, a highly successful effort at the plant of the Riverside Cement Company, Riverside, Calif.

This company, after a number of years of costly litigation with the orange growers in the territory adjacent to the plant, because the mill deposited large quantities of dust on the groves, installed a Cottrell electric precipitator with a sole hope of abating the nuisance.

Word now reaches the Bureau of Mines that the factory of this cement company, during March of this year, went into full blast operation for the purpose of making potash with cement as a by-product. The investigator who reported upon this operation of the plant to the bureau says:

"This is certainly an interesting development of modern industry, where an apparatus installed for the purpose of saving the life of the factory, turns out to be the center of operations around which the entire plant is adjusted, the incidental profits being sufficient, at least during the continuance of the war, to make the former operation of the factory as secondary in importance.

"As there is not sufficient market to take all of the cement, the surplus clinker will be stored until the end of the war. Assuming 0.8 or 1 per cent potash contained in the raw mixture, it is expected to pay the entire operating cost and a reasonable profit from the sale of the potash alone, giving the clinker as absolute profit. It is expected to manufacture 5,000 barrels of cement per day.

"The potash extraction plant has apparently proven its value, and on the average 90% of the total potash contained in the Cottrell treater dust is being recovered in the form of crystallized salts."

Mixing Concrete 90 Seconds

Mixing concrete 90 seconds is a requirement of the Pennsylvania Highway Department, adopted after tests of concrete mixed from $\frac{1}{2}$ minute to 3 minutes, corresponding with 9 to 51 revolutions. The highest strength was that of 1,924 pounds per square inch, corresponding to $1\frac{1}{2}$ minutes mixing, or 26 revolutions of the machine. The minimum strength was of concrete mixed with 9 revolutions in $\frac{1}{2}$ minute that gave a strength of 1,400 pounds. The 3-minute mix with 51 revolutions developed a strength of only 1,673 pounds. The aggregates were handled and measured in special wheelbarrows of 3-cubic feet capacity, which were accurately filled and struck off with a shovel. The amount of water was carefully proportioned to secure a plastic mixture that was not quite leveled down.

Pacific Concrete Pipe Association

The Pacific Concrete Pipe Association, after a three-day convention in Portland, Oregon, recently, the first gathering of cement pipe men ever held in the Pacific Northwest, formed a permanent organization, with the following officers: C. H. Ballen, Portland Cement Pipe & Tile Company, Portland, president; George Scofield, Savage-Scofield Company, Tacoma, vice-president; H. W. Shaw, Harbor City Cement Company, Everett, Wash., secretary-treasurer. Pipe manufacturers from all parts of Oregon, Washington, Idaho and California were in attendance. The association plans to standardize concrete sewer, culvert and drain pipes, and manufacturers will be asked to bring their product up to association specifications.

Elected Secretary Pipe Association

J. H. Libberton, 210 South La Salle street, Chicago, who was elected secretary of the American Concrete Pipe Association at its annual meeting February 15, is division engineer of the promotion bureau of the Universal Portland Cement Company, and has made extensive investigations in connection with the use of concrete tile in the mid-western states, having done extensive promotion work and made investigations on concrete drain tile in 1908 and 1909 when the business was in its infancy. Plans are now in progress to increase the membership of the society and to develop greater usefulness to the members.

New Cement Plant; Spouting Concrete 700 Feet

Ellis Soper, chief engineer of the Cuban-Portland Cement Co., Mariel, Cuba, writes that by the aid of a steel tower 250 feet high some concrete foundations were poured 700 feet away. On account of the hot sun it was found that the use of a small percentage of hydrated lime was very beneficial in aiding the flow of the concrete. Making proper allowance for the relative elevations of the chute and the forms the inclination of the latter was found to be about 17 or 18 degrees.

It is probable, on account of the great height, that the chutes were not easily accessible for cleaning or for the acceleration of the flow and that the flow was continuous and unimpeded. In any event, the horizontal distance spouted was nearly or quite a record and the height of the tower approaches the limit of economy and safety.



Constructing Concrete High School Buildings in Cincinnati

The Main Distributing Tower is 210 Ft. High and a 600 Ft. Range is obtained
with this Spouting System

The East Side High School Buildings of Cincinnati, which are now under construction, are a departure from the usual method of school building, in that the buildings are segregated, thus having the arrangement of a university with a number of buildings instead of the usual method of one building containing all departments.

There will be one building used as an auditorium and for administrative purposes, four buildings as laboratories and for class purposes, one building as a gymnasium for both girls and boys with separate swimming pools; a Power and Industrial Arts Building, and an attractive reinforced concrete bridge crossing the hollow which intervenes between the building site and Madison Road.

The Ferro Concrete Construction Company have the general contract for the five buildings first mentioned, and, as these are spread out covering considerable ground they decided the easiest method of handling the

concrete work was to hoist in the air at a central tower and distribute to the points where it is to be used, by chutes, and for this purpose a tower 210 feet high has been erected.

The contractors also ran a switch from the Norfolk and Western Railroad to the base of this tower so that material could be delivered without hauling. The sand and crushed stone is handled directly from the cars to storage bins with a steam-operated derrick using a clam-shell for unloading. Thus this material is taken by machinery from the cars to the bins and from there goes by gravity into a small car underneath the bins and is dumped directly from these cars into the concrete mixer. The concrete from this mixer dumps directly into a hoisting bucket which is to be hoisted in the tower.

On the side of the tower are hung receiving hoppers which can be raised or lowered on the tower as required. The concrete is dumped from the hoisting

bucket into these receiving hoppers and from there is spouted through steel troughs to the place in the building where used.

By means of this tower and spouting system a range of about 600 ft. can be obtained. Where the distance that the concrete is to be spouted is not too great, the slope of the spouts is a drop of about 3 inches to every



Base of Tower With the Traveling Derrick Used for Unloading Material Shown in the Background.

foot; but where the distances are greater, a drop of 4 inches to the foot is used.

This spouting system is supported by 1200 ft. of 1½-inch diameter Leschen wire rope.

The contract of the Ferro Concrete Construction Company amounts to about \$450,000.

Mortar and Plaster Mixers

Mixers for concrete, mortar and plaster are attractively shown in a catalogue just issued by the Jaeger Machine Company, 212 West Rich street, Columbus, Ohio.

In the foreword these manufacturers say that "mixers, like men, are judged by their work—by what they have done and are doing," and they are willing that their mixers be judged in the same way.

This company has been building concrete mixers ever since the introduction of machine made concrete. They studied and experimented until they had a mixer that answered the purpose, not of a particular class, but of the trade in general.

The result of this experimenting is the Jaeger line of mixers of the improved revolving tilting drum, single opening, self-cleaning type.

This mixer is made with or without power-loader, and in a number of different designs for different kinds of work, including the Jaeger paver; also the machine equipped with a hoist and to which can be attached the Jaeger elevating and spouting plant. This is an outfit which is admirable for foundation, etc., and can be set up quicker than wheelbarrow runs can be put down.

The catalogue also includes mortar mixers and grouting outfits.

It is well worth having on the desk of any man who mixes concrete.

Concrete Pipe

A contract has just been let for over 9 miles of concrete pipe to develop a portion of a new drainage district in South Dakota. One of the largest concrete sewer contracts to use concrete pipe was let a few days ago at Spokane, Wash. The work requires over 30 miles of concrete pipe of various sizes.



A Near View of the 210-ft. Tower and the Spouting System.

Cancel Proposed Rates on Sand and Gravel

Albany, April 3.—The public service commission today cancelled the New York Central's proposed rates on sand and gravel from North Tonawanda to Niagara Falls and Suspension Bridge, and has ordered put into effect on April 10 a rate of thirty-two cents the net ton on minimum carload weights of 80,000 pounds and forty-two cents a net ton on cars of 60,000 pounds.

The road is further ordered to readjust its sand and gravel rates from North Tonawanda to other points on the Niagara frontier in accordance with the Niagara Falls rate established.

This action was taken following complaint of the Buffalo Produce exchange, representing the Frontier Sand & Gravel Co., Buffalo, N. Y., against the forty-seven cent rate proposed by the Central. It developed at the hearings that the River Sand Co. has docking facilities at Niagara Falls for all water carriage of this gravel, while the other corporations are unable to obtain such dockage.—Buffalo Courier.

Contracts have just been awarded for paving with concrete nearly 4 miles on the Duwamish-Renton Junction road in King county, Wash. This is the heaviest traveled road in the state. The concrete stretch will connect two strips of brick pavement—one built in 1915 at a cost of \$39,000 a mile and one, not yet completed, at a cost of \$35,000 per mile. The present award to concrete is said to have been on a basis of \$17,000 per mile.

Cement Mill Superintendent

E. D. Bailey has resigned as assistant superintendent for the Northwestern Portland Cement Company, Mason City, Iowa.



View of the North End of Wabash Portland Cement Plant.

The Wabash Cement Plant has been remodeled and reconstructed

Long famed for its limestone for building purposes, Indiana can now also boast of one of the largest and most modern cement plants. The remodeling and reconstruction of the Wabash Portland Cement plant at Stroh, Ind., has involved many interesting features, including a new wash mill, three new Allis-Chalmers kilns, new power plant, complete electric and individual motor-drive system, a complete new conveying system and a large amount of other new machinery. The entire system of handling both the raw and finished materials was brought up to the very latest practice.

Material

The marl is dredged from beds which border the plant. An industrial railway about one mile long is laid along the marl beds and trains of 3-yard cars are hauled by small locomotives to the plant. Arriving at the plant, the cars are hauled up an incline of about 10° by a cable operated by an electric hoist and dumped directly into a 26-foot American wash mill, furnished by Allis-Chalmers Mfg. Co. This mill has four arms which revolve at 12 r. p. m. To these arms four harrows are hung. By chains attached to these harrows are steel teeth which travel close to the bottom of the mill. Marl, in lumps, dumped into the mill, is at once dissolved into liquid form. The tank part of this mill is made of reinforced concrete 26 feet across, octagon shape and 10 feet deep. A concrete pier in the center of the tank supports the main bearing of the mill and a tunnel underneath provides for periodic clearing of gravel and other foreign substances. The use of this mill insures good clean material freed from all improper matter. A 75-h. p. motor operates the mill.

Handling the Clay

The clay is dug by a steam shovel at Steubenville, 12 miles from the plant, and is hauled to the plant by rail. It is unloaded by a locomotive crane and grab bucket which piles the clay over a tunnel in which

is housed a 24-in. belt conveyor 350 feet between centers. This belt is horizontal in the tunnel but goes up an incline of 19° in a light bridge to the wash mill. This mill is also a 26-ft. American wash mill, a duplicate of the marl mill. The disintegrated clay in liquid form is stored in a large double mechanical agitator to prepare for mixing with marl.

Mixing

The clay is elevated to a double measuring tank. Each tank has a capacity of 50 cu. ft. The chemist having his analysis made of the material knows the amount of clay to be added. This is done very rapidly and there is no time lost in mixing.

Handling the Mixed Material

This material is elevated and spouted to five large storage tanks which are both mechanically and air agitated. This material is known as tube mill feed.

Raw Grinding

At the bottom of the tube mill feed sumps is a pipe line with valves to each sump. This line leads to an elevator pit and material is elevated to a feed box over the tube mills. In this box are two feeder wheels with buckets attached. These wheels feed the tube mills. Feed can easily be increased or decreased accurately by adding or removing buckets. The fine grinding is done by two tube mills,³ one 5x22 feet, one 6x22 feet. The 6x22-ft. mill has a chilled lining and is driven by a 250-h. p. motor. The 5x22-foot mill is driven by a 75-h. p. motor. At normal times all grinding can be done with the large mill.

Slurry Handling and Storage

From the tube mills the material is elevated and conveyed by a 16-inch screw conveyor to nine slurry tanks 14 feet in diameter and 20 feet high. This slurry is air agitated by four 3-inch lines extending into the tanks. These 3-inch lines are fed by a 1-inch pipe with a plug cock to regulate the amount of air to be used. At the bottom of these tanks is another 16-inch

screw conveyor in a concrete trough. This conveyor leads to a small sump mechanically agitated, located under the kilns.

The Kiln Room

The slurry is drawn from the sump under the kilns and elevated to a reinforced concrete feed box. In this box are three feed wheels 5 feet in diameter, which operate at 12 r. p. m. The five elevators which have handled the material up to and including this feed end department are all constructed about the same, only varying in height. The pit is of concrete. A steel frame 6 feet wide and 12 feet long rests on this pit. This frame is covered with metal lath and plaster. This frame or tower supports the elevator head shaft and idler shaft. The elevator has 8-foot horizontal travel, which allows the buckets to thoroughly empty and drip. The take-up is horizontal. Two sets of gears are used and an individual motor, belted, drives each elevator. The speed of the elevator is very slow, with very large buckets. No. 844 Ley bushed chain is used. The kilns are 8 feet 6 inches in diameter and 185 feet long and were furnished by Allis-Chalmers Mfg. Co. They are in two sections and are coupled together with a flexible chain connection allowing for slight expansion and changes in alignment. The kilns are driven by a 40-h. p. variable speed motor. Coal is used in the kiln and the supply is regulated by No. 2 Reeves speed changers furnished by Reeves Pulley Co., Columbus, Ind. The burners are Allis-Chalmers improved type. The clinker is discharged into rotary coolers, 6x50 feet, underneath the kilns. Each cooler is connected with an 8-foot fan⁷ which forces cold air through the cooler. The air then heated is returned to the kilns through two gas ducts or can be diverted to the stacks, if desired. This is all controlled by dampers. The clinker then coming from the cooler is very cool. Seal rings make the coolers air tight. The clinker is discharged from the cooler on a 24-inch pan conveyor which travels horizontally under the coolers but turns up 19° to a measuring tank where gypsum is added. The clinker is then elevated to a belt conveyor, which carries the clinker to the preliminary grinding department or to storage. The present storage is the old kiln room and is about 100x100 feet. The clinker can be piled 21 feet high in this room.

Clinker Grinding Department

The preliminary grinding department has three Sturtevant ring roll mills. Each mill is a unit, one elevator to each mill. This elevator takes the material direct from the mill and elevates it to a screen. The fines are discharged into a 16-inch screw conveyor. The tailings return direct to the mill, which is driven by a 50-h. p. motor. The finish grinding is done by four tube mills, three No. 16 Smidth mills and one Allis-Chalmers mill, each being driven by a 150-h. p. motor belted. The mills discharge the cement into a 16-in. screw conveyor. It is then elevated to another 16-in. screw conveyor in the center of the warehouse, which is being rebuilt to suit the new plant. Two tunnels under the bins have screw conveyors which carry the cement to the sacking room, where sacking machines are used. A belt has just been installed which carries the bags direct to the cars on the siding.

The Power Plant

The power plant is strictly modern in every way. Two turbines furnish the power, one 750-k. w., one 625-k. w. Allis-Chalmers. Vertical Allis-Chalmers motor driven condensers are used. A booster pump at the lake furnishes water for these condensers. An 11-panel

switchboard shows the distribution of the power. An 800-ft. two-stage air compressor will soon be installed, completing the power plant. Five vertical boilers, which are equipped with stokers, furnish steam for this plant. The coal and ash system is strictly modern.

The Coal Handling Plant

A very complete coal handling plant has been installed, having a capacity of 50 tons per hour. Slack coal is received in bottom dump cars, which empty into the track hopper. A pan conveyor then feeds the large gravity discharge elevator. Two 24-in. belt conveyors carry this coal to storage or directly to the mills. The belt to storage is 150 feet long and 25 feet above the ground, carried in a light steel bridge. An automatic tripper distributes the coal over the pile, under which is a tunnel. A 24-inch belt in this tunnel takes the coal back to the same elevator and it is elevated to a belt, which carries the coal to a tower. In this tower is a revolving screen which separates the fine dust. The nut coal is carried by another belt to the boiler room. Two 30-ton tanks afford storage for the boiler room. The fine coal is discharged into two 50-ton tanks outside the coal plant.

The Coal Grinding Plant

The coal from the outside tanks is elevated to a bin over the dryer. The coal dryer was made from one of the old kilns and it discharges direct to an elevator. A screw conveyor from this elevator supplies the Raymond mill tanks. Two five-roll Raymond mills are used for grinding. A 100-h. p. motor with two pulleys drives both fan and mill. The separators discharge the fine coal into a screw conveyor which carries the coal to the kiln room.

Buildings

The new buildings which house the kilns and wash mills are of most modern construction, structural steel with concrete stucco on metal lath, and concrete tile roof. These buildings are, therefore, fire-resisting and of a very permanent nature.

The entire electrical equipment was furnished by the Allis-Chalmers Mfg. Co., Milwaukee.

L. L. Stone, chief engineer of the Hunt Engineering Co., Kansas City, Mo., had charge of the changes. W. J. Swegman, res. engineer for the Hunt Engineering Co., was located at the plant during the earlier part of the construction and designing, and is superintendent for the Wabash Portland Cement Co.

Wing Resigns from Wolverine Leaving Company Prosperous

At the annual meeting of the stockholders of the Wolverine Portland Cement Company L. M. Wing tendered his resignation as president and general manager and Frank M. Rudd, of Bronson, was unanimously chosen to take his place. Mr. Wing, a veteran soldier of the Civil war, though feeble in health, continued in active charge of the business of the company, operating the two plants. The company increased its output of 1916 almost 14 per cent, its shipments 20 per cent and an increase of 48 per cent over the previous year. A dividend of \$20,000 was paid the stockholders in 1916 and the securing of the big order for furnishing the cement for road building in Detroit and Wayne county this year promises an active and profitable business for 1917.

A Modern Crushing Plant

Of all branches of the stone industry, the production of crushed rock requires the greatest amount of care for economy in handling because of the small margin of profit. A very complete and modern equipment is that of the Temescal Rock Company, located near Corona, Cal. The situation in Temescal canyon provides a slope that offers exceptional conditions for handling the product by gravity. The first unit of the plant now completed will have an initial capacity of 1,500 to 2,000 tons of crushed rock a day. This ca-



Temescal Rock Co.'s Plant Near Corona, Calif.

capacity may be doubled and trebled if the market justifies with very little interference in the operation of the first unit. The company is also perfecting plans for installing cableways to load large rocks up to 12 tons in weight for riprap and sea wall construction. This installation will also be in unit, each with a capacity to load one thousand tons of rock a day on railroad cars, and it has room for five units of this plant.

There are many interesting features in the operation of this quarry and crushing plant. The rock is an altered rhyolite porphyry. The quarry faces extend along the mountain side, both north and south of the head of the crushing plant. While one end of the quarry is being drilled and blasted, the broken rock on the other end is being loaded into cars and hauled to the crusher. A powerful steam shovel loads the broken rock into all-steel dump quarry cars. These cars are operated by electric motors, receiving current from a third rail. By a system of levers in a tower over the crusher, operated by one man, an empty car is sent to the steam shovel, and when loaded, brought back and spotted at the chute to the initial crusher, into which the load is dumped by pulling another lever. Thus, one man takes the place of six men necessary to operate two trains of cars hauled by donkey engine locomotives, and four cars, operated singly, take the place of the two trains. Then, if the power goes off, as it sometimes will, there is a minimum of quarry rock in the chute.

The initial crusher, jaw type (manufactured by Worthington Pump & Machinery Co., power and mining machinery works, Cudahy, Wis.), will receive a 10-ton piece of rock and break it down to a maximum of 10-inch pieces in less than two minutes, which is its justification, because it eliminates all sledging and nearly all reblasting in the quarry. The capacity of

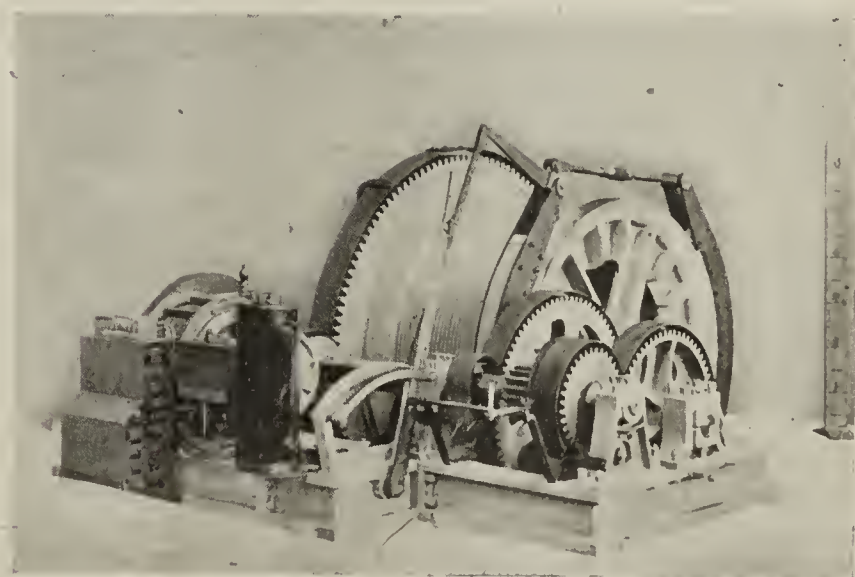
this machine is rated at 600 tons an hour, so without duplicating it the capacity of the plant may be trebled.

The product of the big jaw crusher slides down into a No. 9 McCully gyratory crusher, which further reduces it to three and a half inch maximum pieces. The product from this machine is carried by a belt conveyor to revolving screens, which take out all that is broken to two inches or less, and the portion over two inches in size is fed down to large disc crushers, from which it does not escape until it is finished by being broken to two inches or less in size. The finished product is carried on a belt conveyor from the scalping screens and disc crushers to the sizing screen over the storage bins, where it is separated into the various commercial sizes. Those sizes of smallest volume are conveyed by chutes direct into the bins nearest the screen, and those of larger volume are carried by shuttle belt conveyors to bins farther away.

As the quarry floor is located on the side of the mountain, and all of the heavy crushing machinery is located just below the quarry floor, it has been necessary to install a special incline arrangement for handling this crushing machinery. The incline is about 48½ per cent and 550 feet long. The design of same was such that the loaded cars which were received from the railroads were hauled directly to the quarry floor and unloaded there by means of a large traveling crane. It was therefore necessary to unload the material at the bottom of the incline, and the expense of rehandling was thus not incurred.

Owing to the unusual loads and the steep grades, it was necessary to design a special arrangement, which is rather unique, in that a sheave car precedes the railroad car, and is attached by means of two 1¾-inch plow steel ropes to a barney car located behind the railroad car. The sheave car provides for three parts of rope in order to take care of the unusual stresses developed, and to keep the size of the hoist equipment to a minimum.

The barney car is of the Lidgerwood Manufacturing Company's standard design, built throughout of



The Lidgerwood Hoist.

structural steel, and operates on a standard gauge track instead of a narrow gauge track, as is the common practice. Switching arrangements are provided at the bottom for getting the barney car out of the way while the railroad car is being located at the foot of the incline.

The hoist was built by the Lidgerwood Manufacturing Company and is shown in the accompanying photo-

graph. It is a large single-drum two-speed outfit, drum being 66 inches diameter, 44-inch face, equipped with a very powerful post brake. It is geared by means of steel gearing, to a 75 h. p. motor, the latter being equipped with solenoid brake sufficiently powerful to bring the entire system to rest in case of failure of the current supply. The design is such that loads may be either hoisted or lowered electrically, that is, when a loaded car is being lowered the motor will act as a generator and will return the current to the power circuit. Loads of 131,000 lbs. have been hoisted to the quarry floor without any difficulty whatever.

At the conclusion of the construction period, the three-part arrangement with the sheave car and the barney car will be dispensed with, and the hoist will operate with a single line to a supply car for hauling the usual quarry supplies to the quarry floor.

Crushed Stone Company Cuts Haulage Costs Half

John Herzog & Son, crushed stone producers, of, Patterson and Forest, Ohio, have decreased cost of production to a considerable extent by speeding up the haulage from the quarry to the crusher. Economies in this direction, since the installation of its present haulage system, have amounted from 30 to 50 per cent.

Like many other quarries, horses were employed in the early history of the business, but these soon made way for the more efficient steam locomotive. The steamer succeeded in speeding up the plant, in cutting



Plymouth Gasoline Locomotive Hauling Cars of Crushed Stone

down costs generally and, of course, was a great improvement over the horse-driven system.

But, there came a day when Mr. Herzog determined that even the steamer could be improved upon and he began to investigate the various types of locomotive haulage system. The gasoline, electric and compressed air motors were considered and thoroughly investigated, and, after all points were considered, he selected the gasoline locomotive as the most efficient of the three.

It was a question of which gasoline locomotive now, and his final selection rested with a friction-drive transmission type, this design having the best all-round record. A three-ton locomotive of this type was purchased and installed. Let Mr. Bert Herzog of the John Herzog & Son tell the result of this selection in his own words:

"We replaced our steam locomotive with The Plymouth Friction-Drive Gasoline Locomotive, made by the J. D. Fate Co., 220 Riggs avenue, Plymouth, Ohio, after we had investigated gasoline locomotives generally. This little locomotive cost us considerably less to buy than the steamer we had, and much less than any of the other gasoline, electric or air motors offered us, and certainly represents a decided saving in the cost of operation.

"In the first place we do not have to employ a licensed engineer as we did with the steamer, and a \$2-a-day laborer runs The Plymouth. We never kept a record of the tonnage hauled by the steamer, but we do know that The Plymouth costs much less for fuel and general operation expenses and that we are not only hauling more material, but speeding up the entire plant.

"The Plymouth is consuming on the average of four to five gallons of gasoline per day and about one quart of lubricant, which is a decided saving over our coal and lubricant bills for the steamer.

"We would consider The Plymouth far cheaper to operate than a horse-driven, steam or other power-driven hauling system, this being because we save in fuel, water, in up-keep and in every other point.

"The Plymouth Friction Drive has given us no trouble whatsoever, and we have less loss of power than we had in our steam dinky, our repair bills are practically nothing and the fibre on our friction drive certainly eliminates the cost of transmission lubricants. We cannot praise The Plymouth too highly."

One of the advantages of the friction-drive transmission over the ordinary gear transmission of the average gasoline industrial locomotive is that it practically eliminates repairs, there being no danger from stripped or craked gears, and there is nothing to wear except the friction rim, which usually runs 10,000 or more miles, if proper care is given it.

Another advantage is in the variable speeds of the friction-drive. There is no shifting of gears. The operator can move his locomotive from the lowest possible speed, gradually, or suddenly, up into the highest, which is twelve miles per hour, and do this by merely throwing a small lever.

Efficiency in Dust Collecting

A few years ago everyone thought that smoke, noise and dust were a necessary part of every manufacturing enterprise. One by one these evils have been subdued; smoke is recognized as a waste caused by careless firing, noise is only the protest of machinery working at a disadvantage. Dust has defied control to an unwarranted degree, and many concerns have suffered because it was not controlled.

The American Automatic Dust Filter, made by the Clark Dust Collecting Co., Fisher Building, Chicago, Ill., is designed to collect the dust or solid particles resulting from any kind of manufacture. The system has been successfully used in Smelting and Refining Works, Cement Mills, Cereal Mills, Grain Elevators, Potteries, Paint Mills, Tobacco Factories, and in almost every industry where the dust was a menace to health or comfort.

Being specialists in dust collection and conservation, the Clark Dust Collecting Co. is ready to advise our readers how to solve their dust problems, whether for the simple purpose of reducing the dust or for saving the by-products which would otherwise be dissipated and wasted.

Giant Cement Company

Giant Portland Cement Company stockholders approved a change in the seven per cent cumulative preferred stock requirement, which provides for redemption in whole or in part of 105. The change was made to meet requirements of the Philadelphia Stock Exchange, which, it is expected, will shortly approve listing of the preferred and common stock.

Suggested Specifications for Concrete Floors

As Prepared and Published By Portland Cement Association

General Requirements

Materials

1. **Cement:** The cement shall meet the requirements of the current Standard Specifications for Portland Cement adopted by the American Society for Testing Materials. The cement when used shall be in perfect condition and contain no lumps which cannot be pulverized between the fingers.

2. **Aggregates:** Before delivery on the job, the contractor shall submit to the architect or engineer a fifty (50) pound sample of each of the aggregates proposed for use. These samples shall be tested, and if found to pass the requirements of the specifications, similar material shall be considered as acceptable for the work. In no case shall aggregates containing frost or lumps of frozen material be used.

(a) **Fine aggregate:** Fine aggregate shall consist of natural sand or screenings from hard, tough, crushed rock or gravel, consisting of quartzitic grains or other equally hard material graded from fine to coarse, with the coarse particles predominating. Fine aggregate, when dry, shall pass a screen having four (4) meshes to the linear inch; not more than twenty-five (25) per cent shall pass a sieve having fifty (50) meshes per linear inch; and not more than five (5) per cent shall pass a sieve having one hundred (100) meshes per linear inch. Fine aggregate shall not contain vegetable or other organic matter nor more than three (3) per cent by weight of clay or loam. Field tests may be made by the architect or engineer on fine aggregate as delivered at any time during progress of the work. If there is more than five (5) per cent of clay or loam by volume in one (1) hour's settlement after shaking in an excess of water, the material represented by the sample shall be held pending laboratory tests.

Fine aggregate shall be of such quality that mortar composed of one (1) part Portland cement and three (3) parts fine aggregate, by weight, when made into briquets, shall show a tensile strength at seven (7) and twenty-eight (28) days at least equal to the strength of briquets composed of one (1) part of the same cement and three (3) parts Standard Ottawa sand, by weight. The percentage of water used in making the briquets of cement and fine aggregate shall be such as to produce a mortar of the same consistency as that of the Ottawa sand briquets of Standard consistency. In other respects all briquets shall be made in accordance with the methods of testing cement recommended by the American Society for Testing Materials. (See Cement Specifications A. S. T. M.)

Note—These specifications apply to floors in buildings, whether subjected to moderate or heavy traffic, and cover the laying and finishing of the floor; also its protection during early hardening.

For architects, engineers and others desiring to embody these specifications in their general specifications covering a particular piece of work, the following outline of the paragraphs necessary to meet different conditions will prove convenient:

Floors Laid on Ground—Moderate or Light Traffic.

Two-Course—Paragraphs 1-15 (except 2c); 30-47; 49-52.

One-Course—Paragraphs 1-15 (except 2c and b); 30-42; 53-57.

Floors Laid on Ground—Heavy Traffic.

Two-Course—Paragraphs 1-15; 30-46; 48-52.

Reinforced Concrete Floors—Moderate or Light Traffic; Paragraphs 1-22 (except 2c); 24-29.

Heavy Traffic; Paragraphs 1-23; 25-29.

(b) **Coarse aggregate:** Coarse aggregate shall consist of clean, hard, tough, crushed rock or pebbles graded in size, free from vegetable or other organic matter, and shall contain no soft, flat or elongated particles. The size of the coarse aggregate shall range from one and one-half ($1\frac{1}{2}$) inches down, not more than five (5) per cent passing a screen having four (4) meshes per linear inch, and no intermediate sizes shall be removed.

(c) **No. 1 Aggregate for Wearing Course:** No. 1 aggregate for the wearing course shall consist of clean, hard, tough, crushed rock or pebbles, free from vegetable or other organic matter, and shall contain no soft, flat or elongated particles. It shall pass when dry a screen having one-half ($\frac{1}{2}$) inch openings and not more than ten (10) per cent shall pass a screen having four (4) meshes per linear inch.

3. **Mixed Aggregate:** Crusher-run stone, bank-run gravel for mixtures of fine and coarse aggregate prepared before delivery on the work shall not be used.

4. **Subbase:** Only clean, hard material, such as coarse gravel or steam-boiler cinders, free from ash or particles of unburned coal, shall be used in the subbase: (Note: Eliminate this clause when subbase is not required.)

5. **Water:** Water shall be clean, free from oil, acid, alkali or vegetable matter.

6. **Color:** If artificial coloring matter is required, only those mineral colors shall be used which, in the amount hereinafter specified, will not appreciably impair the strength of the cement.

7. **Reinforcement:** The reinforcing metal shall meet the requirements of the current Standard Specifications for Steel Reinforcement of the American Society for Testing Materials. It shall be free from excessive rust, scale, paint or coatings of any character which will tend to reduce or destroy the bond.

8. **Joint Filler:** The joint filler shall be a suitable compound that will not become soft and run out in hot weather, nor hard and brittle and chip out in cold weather; or, prepared strips of fibre matrix and bitumen as approved by the architect or engineer. The strips shall be one-half ($\frac{1}{2}$) inch in thickness and their width shall at least equal the full thickness of the slab.

Measuring and Mixing

9. **Measuring:** The method of measuring the materials for the concrete or mortar, including water, shall be one which will insure separate and uniform proportions of each of the materials at all times. A sack of Portland cement (94 pounds net) shall be considered as one (1) cubic foot.

10. **Machine Mixing:** All concrete shall be mixed by machine except when the architect or engineer shall otherwise permit under special conditions. A batch mixer of an approved type shall be used. The ingredients of the concrete or mortar shall be mixed to the specified consistency, and the mixing shall continue for at least one (1) minute after all the materials are in the drum. Raw materials shall not be permitted to enter the drum until all the material of the preceding batch has been discharged.

11. **Hand Mixing:** When it is necessary to mix by hand, the materials shall be mixed dry on a watertight platform until the mixture is of uniform color, the required amount of water added, and the mixing con-

tinued until the mass is of uniform consistency and homogeneous.

12. Retempering: Retempering of mortar or concrete which has partially hardened, that is, remixing with or without additional materials or water, shall not be permitted.

Protection

13. Treatment: As soon as the finished floor has hardened sufficiently to prevent damage thereby, the floor shall be covered with at least one (1) inch of wet sand, or two (2) inches of sawdust, which shall be kept wet by sprinkling with water for at least ten (10) days.

14. Protection: The freshly finished floor shall be protected from hot sun and drying winds until it can be sprinkled and covered as above specified. The concrete surface must not be damaged or pitted by rain-drops, and the contractor shall provide and use when necessary sufficient tarpaulins to completely cover all sections that have been placed within the preceding twelve (12) hours.

15. Temperature Below 35 Degrees Fahrenheit: If at any time during the progress of the work the temperature is, or in the opinion of the architect or engineer will within twenty-four (24) hours drop to 35 degrees Fahrenheit, the water and aggregates shall be heated and precautions taken to protect the work from freezing for at least five (5) days.

Reinforced Concrete Floors

For reinforced concrete floors the following will apply in addition to the general requirements:

16. Forms: The forms shall be substantial, unyielding and so constructed that the concrete will conform to the designed dimensions and contours, and shall also be tight to prevent the leakage of mortar. The supports for floors shall not be removed in less than ten (10) days after the concrete is placed, and then only with the consent of the architect or engineer in charge. When freezing weather occurs, the supports shall remain in place an additional time, equal to the time the floor has been exposed to freezing.

17. Reinforcement: Reinforcing metal shall be provided as called for on the plans. It shall be placed as indicated and mechanically held in position so that it will not become disarranged during the depositing of the concrete. Whenever it is necessary to splice tension reinforcement, the character of the splice shall be such as will develop its full strength. Splices at points of maximum stress shall be avoided. Splicing by lapping bars without contact and with space between bars along the over-lap equal to twice the thickness of the bars is preferable to mechanical splices or clamps.

(To be Continued)

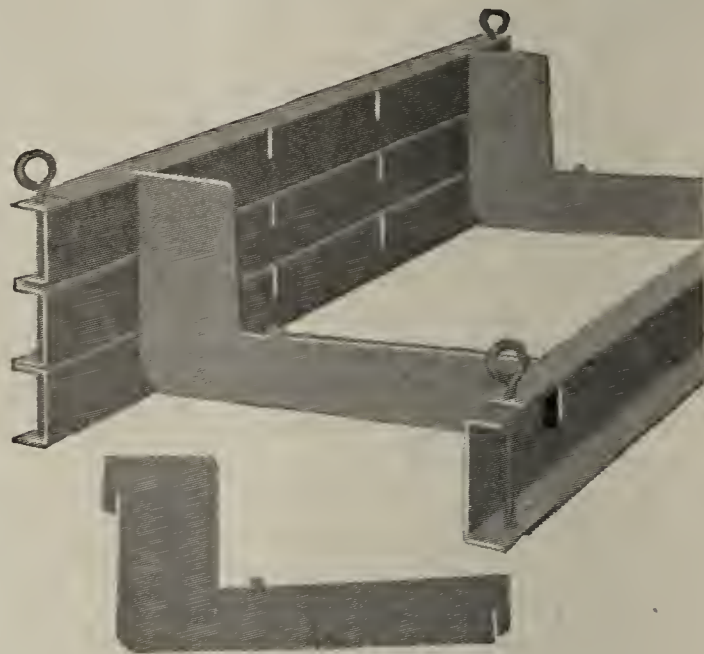
Concrete Roads

The Board of Freeholders of Burlington county, N. J., awarded the contract for paving Broad street, Palmyra, with concrete, to an Atlantic City contractor. This is a reinforced job and the contract price was \$2.40 per square yard.

Lakewood, N. J., voted favorably on a bond issue of \$60,000 for street improvement work. The bond issue specified concrete as the material to be used. Concrete streets were laid in Lakewood last year under inspection by the Portland Cement Association and are reported in excellent condition. This has undoubtedly helped materially to cause the specifying of concrete in the present instance.

Steel Forms For Sidewalk, Curb and Gutter Construction

Better work can be had with steel forms made by the Indiana Concrete Mold Company, 216 E. River street, Peru, Ind., because of their simplicity and perfectness (no keys, bolts, wedges, ratchets or screws are used and to get lost or misplaced), and because these forms are practically self-contained with few parts.



Your cost will also be smaller in doing your work because of the saving in labor and expense of buying temporary wood forms. And bigger profits can be made because more work can be done in a given time, more contracts secured at better prices and because with Indiana steel forms you have permanent equipment to work with.



WHITE CEMENT

The most interesting and complete white cement book ever published is now ready for distribution by the Sandusky Cement Company, 626 Engineer Bldg., Cleveland, Ohio. It conforms to the size adopted by the American Institute of Architects, and has 75 half-tone illustrations of work done in this country and abroad in which Medusa White was an important factor.

It contains much information about stucco—colors, finishes, aggregates, etc., and also covers other subjects for which Medusa White is particularly suitable—concrete blocks, bridges, floors, mantels, artificial marble, building trim, pergolas, garden furniture, ornamental cast stone, monuments, grave stones and concrete specialties. Tests, specifications and testimonials are also shown.

Architects, contractors, block makers and artificial stone manufacturers will find the new Medusa White Cement catalog extremely valuable. It will be sent without charge, on request, to the readers of Cement and Engineering News.

The Ferguson Synstone System

(Synthetic Stone)

The Last Word in Concrete Wall Construction

By John R. Ferguson.*

Why use a concrete wall with two sides when one side answers the purpose just as well, and costs only about one-half as much as the old way?

You use only one-half as much material and labor. Every time you make and lay a block you have made and laid two square feet of wall. Think of it! The equivalent of 46 brick! A block is made in 1½ minutes and laid in 2 to 4 minutes. It is made of true concrete material (not like the one-piece cement block made of sand and cement mixed comparatively dry, which produces a block so porous that when laid in a wall it must be furred, lathed and plastered to make the inside dry. You may pour a bucketful of water

inner side is a circulating air chamber that makes the wall absolutely impervious to moisture and practically impervious to heat and cold.

Several years ago Thomas A. Edison predicted that "Science will some day give every man a concrete house at no greater cost than frame construction." The building world gave eager attention to his words and there are today thousands of would-be home builders awaiting the realization of this prophecy. In the Synstone single wall you have Edison's dream come true. A concrete house at no greater cost than an average wooden structure. At each joist course a strip of steel three-eighths inch thick is laid in the



The above illustration shows a portion of the Model City of Morgan Park, Minn., owned by the Minnesota Steel Company (a subsidiary of the United States Steel Corporation). Homes for 350 families have been completed using the Synstone single wall 8 inches thick throughout. In the construction of these buildings, plaster board and one coat of hard plaster were used for the inner wall.

into such a block without a single drop going through onto the floor, and it has an exterior appearance that looks like moulded putty). Synstone may be faced with beautiful crushed natural material one-quarter inch thick and the body of the block is made of one part Portland cement, two and one-half parts sand and fine gravel, to one-quarter inch screen, and four parts of one-inch gravel or broken stone, and made wet, so wet that it quakes in the machine. The concrete man knows that this is 100 per cent concrete and impervious to moisture. These blocks will withstand a crushing strain of 3,000 pounds per square inch and 1,700 degrees of heat for one hour without a particle of injury to the block. The Synstone wall is so strong that the nine-inch wall may be loaded beyond building ordinance requirements for a sixteen-inch wall. Common wood lath and plaster, or plaster board constitute

the other side of the wall. Between this outer and mortar joint and bolted together at the four corners of the building. This makes a fireproof bed for the joist and if the building burns the joist support is in place for rebuilding. The expense of these steel joist supports is very little and worth many times their cost. They also serve to tie the building together at each joist course in a way that makes it practically tornado proof. It is not necessary, however, to use these steel joist supports. A wood two by four-inch laid in a recess that may be provided for in the web of the block, makes a good joist support.

This single wall is ideal for ordinary buildings of three stories or less. It is built in either nine-inch or thirteen-inch construction and is suitable for residences, stores, school houses, garages, dairy houses, barns, warehouses, factories, railroad stations and freight houses and other construction of not over three stories.

*Prest. Ferguson Synstone Co., Denver, Colo.

Successful Operation of an Exclusively Agricultural Lime Plant

Illustrated herewith is the plant of the G. C. Buquo Lime Co. of Hot Springs, N. C., which is said to be one of the largest and best equipped grinding plants for the production of agricultural lime in the South. The plant is located on the Southern Railroad, a short distance from Hot Springs, in Western North Carolina.

The stone is quarried from a ledge of pure dolomitic limestone which extends to an elevation of over 100 feet above the railroad track. The entire output from the quarry is prepared for agricultural use.

The stone, after being blasted and broken in the quarry to a size which can be handled by men, is brought to a No. 7½ gyratory crusher, which reduces it to sizes suitable for feeding a Hercules mill; but before going to the mill the rock, if at all damp, passes through a rotary dryer to remove the moisture. The Hercules mill grinds it in one operation to a fine flour. This mill is manufactured by the Bradley Pulverizer Co. of Boston, Mass.

The pulverized limestone is elevated and conveyed

fertilizer manufacturers with ground stone especially adapted to their requirements.

Railroad track scales have been installed to insure exact weights of bulk carloads.

During the past year a preference for bagged lime over bulk shipments has developed. For convenience in hauling, 100-pound heavy paper bags of the Bates type have been adopted.

G. C. Buquo is in charge of factory operation; H. Hartshorn, assistant. The sales department is located in the Palmetto Building, Columbia, S. C.; E. S. Mather, manager.

Link-Belt Catalogues

The latest publications of the Link-Belt Company of Chicago are:

Link-Belt Wagon and Truck Loaders; Traveling Water Screen for Condenser Intakes; Modern Coal Tipples; Handling and Storing of Coal and Ashes.

Each of the catalogues is richly endowed with illustrations and accompanied by descriptive matter showing in detail the best methods of application. Send for a copy.



Grinding a Mountain of Lime, at Hot Springs, N. C. Plant of the G. C. Buquo Lime Co. The Bradley Hercules Mill Operated by This Company is the Largest Agricultural Limestone Pulverizer in Existence.

from the mill directly to cars, if it is to be shipped in bulk, or to a Bates bagging machine, if it is to be shipped in paper bags. The conveyors also lead to large storage bins, where 15,000 tons of ground material can be stored ready for shipment. The G. C. Buquo Lime Co. found such a large demand for its product during the season when the farmers wish to apply the limestone that they considered it advisable to build this large storage so as to be in a position to make prompt shipments at all times.

The power used is supplied by a steam power plant, located adjoining the pulverizing department. Three boilers have been installed in the boiler room. Since it is necessary to operate but two of the boilers at one time, there is always one boiler in reserve. A 400-horse-power engine drives the pulverizing machinery.

This plant has a daily capacity of 500 tons of agricultural lime, testing from 94 to 98 per cent in carbonates. Buquo lime contains a considerable percentage of carbonate of magnesia, in combination with carbonate of lime, an advantage in correcting soil acidity. The stone is ground exceedingly fine to increase its availability.

The company has made a specialty of supplying

Feeding Pulverized Fuel in Cement Kilns.

A bulletin has just been issued by the Locomotive Pulverized Fuel Company outlining the application of their low pressure feeders to new or existing cement kilns. It describes the application and advantages of low pressure fuel feed. Air is delivered at 8 ounces pressure, instead of 80 pounds, and the bulletin outlines how a saving of 160 horse-power or 97 per cent can be saved by using the low pressure system. Depending upon the size of the plant this saving has amounted to as high as \$1,500 per kiln per year.

Low pressure feed allows a more uniform feed and insures regularity of temperature. This is reflected in a greater kiln capacity and less fuel consumption per barrel of cement produced. Screw feeds are used to carry the pulverized fuel to the commingling chamber. The fuel is here delivered to the center of a hollow column of air where it is mechanically commingled. This insures a uniform distribution over the area of the feeder outlet.

The equipment can be applied to any existing pulverized fuel instillation.



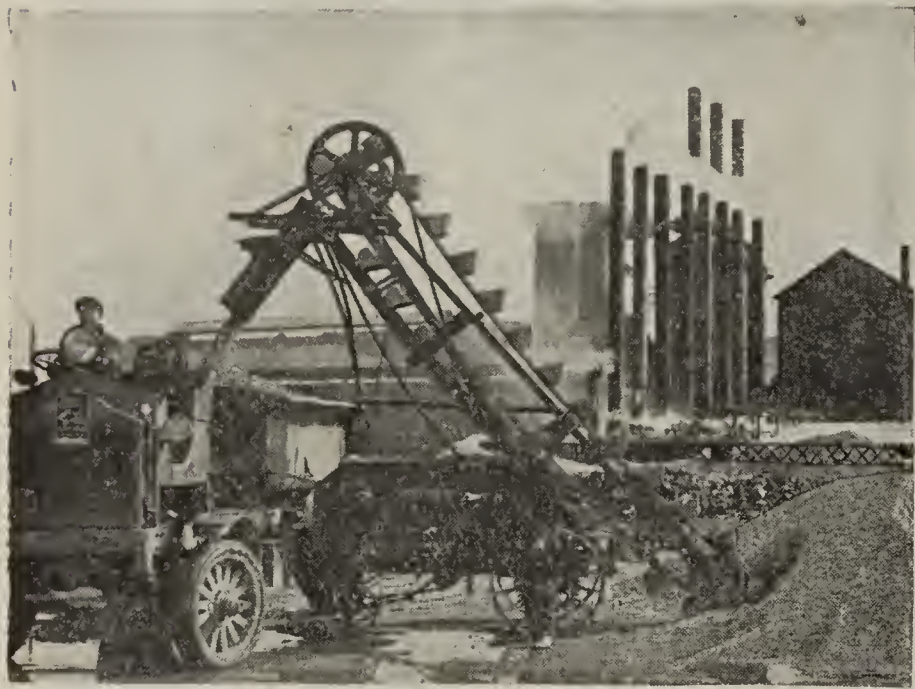
It's a
“LONGLIFE”
CONVEYOR BELT
-the belt you need now
and will eventually buy

MADE BY
THE B.F. GOODRICH COMPANY
AKRON, OHIO.



An Efficient Truck Loader

Large quantities of sand and broken stone are delivered by barges to the Engineering Supply & Erection Co., Hudson street, Jersey City, where they are unloaded by dredge buckets and stored in large piles on the surface of the ground. The materials are loaded into horse and automobile trucks by a Jeffrey wagon and truck loader of the rigid type A-16 which



Loading Sand to 7-Ton Sterling Automobile with Jeffrey Loader Driven by Gasoline Engine. Southern Sand, Gravel & Supply Co., Columbus, Ohio.

consists essentially of a power-driven inclined bucket conveyor mounted on a locomotive truck.

The machine, about 15 ft. long and 13½ ft. high over all, is entirely of steel and its framework is carried on a truck with two large, geared driving wheels and two small sprocket-driven wheels, all on 5-ft. gage. A 5-hp. electric motor operates both conveyor and locomotive gear while a hand winch is provided for adjusting the lower end of the conveyor, close to the surface of the ground. The upper end of the conveyor, 13½ feet above the surface of the ground, discharges into a pivoting hopper with a short adjustable chute which delivers into and trims the material in the truck.

Loading 7-Ton Automobile Truck With Sand from Screening Plant

The machine is operated by one man and under favorable circumstances will load from 1 to 1½ yards of material per minute. It advances under its own power until the lower end of the conveyor engages the toe of the material pile when the elevator is started and automatically continues loading as long as the material falls into the buckets. It is necessary, however, to keep it from penetrating the pile so far as to be choked by the overhanging material. A helper is usually stationed at the foot of the conveyor to make sure that it is operating properly and to look out for irregularities of operation, although generally his services are nominal.

This machine weighs about 6,200 lbs. and has been in operation 1½ years with satisfactory results and without requiring much repairs. For this purpose it saves about 60 per cent of the ordinary cost of loading trucks by hand. It moves to different parts of the yard as rapidly as man would walk and is suited for handling almost any kind of loose material such as sand, gravel, broken stone up to 3½ inches, coal, ashes and other material.

Another machine of the same type that with its gasoline engine weighs 6,700 lbs. has been installed in

the plant of the Southern Sand, Gravel & Supply Co., Columbus, Ohio, where it is chiefly used to load 7-ton automobile trucks with fine sand from the adjacent screening house that is delivered by a drag conveyor to a storage pile in the yard.

Formerly the sand was loaded on trucks by hand, a practice that was discontinued not only on account of the labor cost, but also because a large loss was occasioned by the trucks waiting for loads. The machine loads 7-ton trucks in from four to six minutes, according to the height of stock pile.

When the machine was operated in the gravel pile in the same yard it loaded 187 2-yd. wagons in one afternoon. This machine has paid for itself in less than two months' service.

Bulletin and full particulars regarding Jeffrey Self-Propelling Loaders may be obtained by writing to the Jeffrey Manufacturing Co., 914 North Fourth street, Columbus, Ohio.

From a British Cement Manufacturer

The manager of the Aberthaw & Bristol Channel Portland Cement Company, Ltd., Aberthaw, Glam., Great Britain, writes us as follows:

"I shall be glad to hear if you can put us in communication with some of your readers to help us in our particular industry. We are manufacturers of Portland Cement from cement rock and marl, very similar in analysis to that of the Lehigh Valley deposits, Pennsylvania.

"We have, however, too much marl in our quarries, which has to be separated from the stone, which process is most difficult and is aggravated in wet weather when the material becomes sticky.

"The size of the stone dug by means of our two steam navvies, varies from 4x4x2 feet 6 inches downwards.

"We require 5,500 tons of raw material weekly, and our present Crushing Plant consists of three 36x24-inch jaw crushers.

"I shall be glad to hear if any of your subscribers who work under similar conditions can give us information as to how to deal with this size stone, that is, crushing the stone and getting rid of the excess marl in both wet and dry weather."

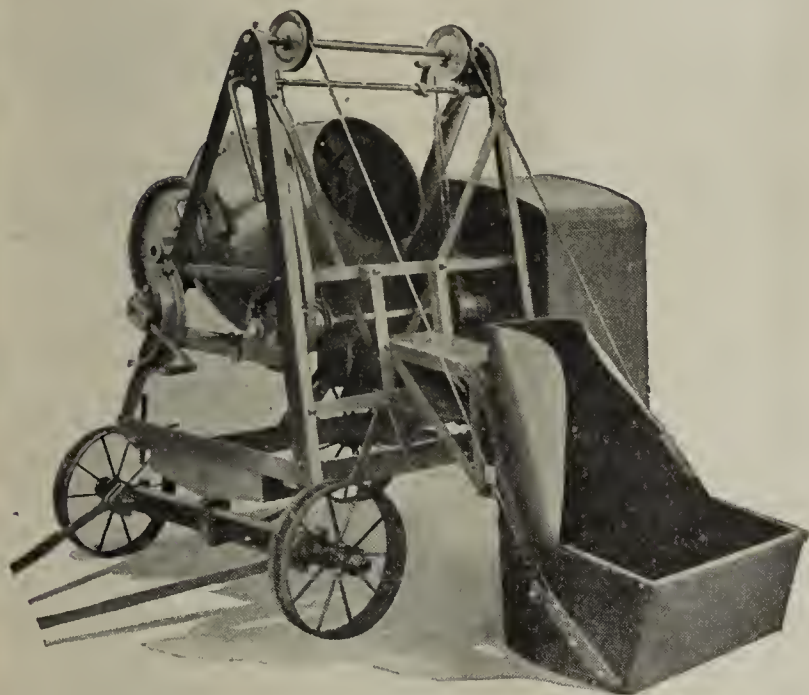


Jeffrey Self-Propelling Loader, Motor Driven, Loading Crushed Stone at the Yards of the Engineering & Erection Co.

JAEGER

BIG-AN-LITTLE

MIXERS



Everything a batch mixer ought to have is contained in this machine.

Our Tilting Drum guarantees a perfect "speedy mix"—single opening, large capacity, easy to load and unload and always clean.

The Drum is entirely open to view at all times.

The Mixer has proven by test to be most economically operated.

And, don't forget, you get A MIX A MINUTE.

Our new folder shows the entire line.

Write for your copy now.

THE JAEGER MACHINE COMPANY 212 W. RICH STREET COLUMBUS - OHIO

Packard LOW CHARGER

The "Easy to clean," Patented "High Speed" Mixing and Discharge Action is one of the few that successfully and fast handles

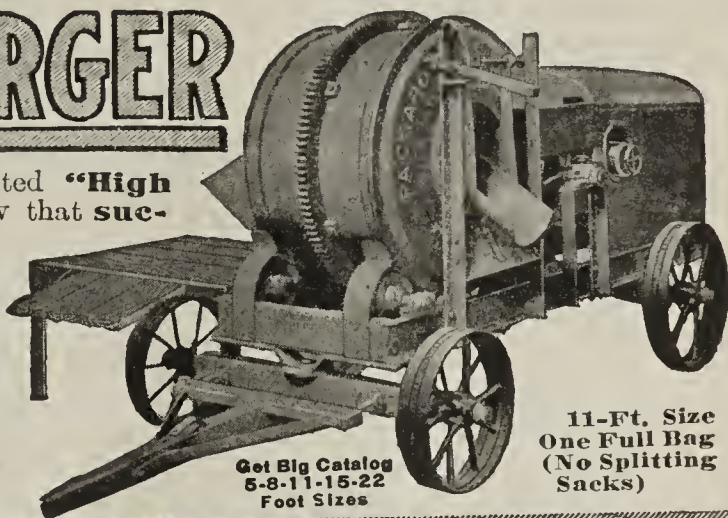
STIFF CONCRETE FOR CURBS, GUTTER AND SIDEWALK WORK

Get our astonishingly low prices on these sturdy, built-of-steel mixers—also our Terms. 6 and 11-ft. sizes—also with Loaders. Quick deliveries from stock carried in all large cities. Write nearest office

The American Cement Machine Co. Inc.

Keokuk Iowa
THE 300,000 HP ELECTRIC CITY

BRANCH OFFICES—New York, Philadelphia, Pittsburgh, Baltimore, Richmond, Cambridge, Mass.; Indianapolis, Chicago, New Orleans, Minneapolis, Seattle, Spokane, Los Angeles, San Francisco, Cleveland, St. Louis, Louisville.



11-Ft. Size
One Full Bag
(No Splitting
Sacks)

Get Big Catalog
5-8-11-15-22
Foot Sizes

PAVERS-GROUTERS-STOCKS-BACKERS

DUNN CONCRETE MIXERS

A Handwheel On Each Side

Hand labor is expensive and hard to get. The Dunn Mixer does the work of several men, and does it better. Five big features assure a degree of mixing efficiency, rapidity and economy possessed by no other mixers of the popular tilting drum type. The Dunn machine has the discharge-from-either-side feature; the double-handwheel is exclusively a Dunn innovation.

In size and price the Dunn is just right, for average contracting. Easy to operate, economical to run. Built rugged enough to withstand the hardest usage. Write for Dunn Mixer Bulletin. Agents Wanted.

W. E. DUNN MFG. CO., 414 24th St., Holland, Mich.

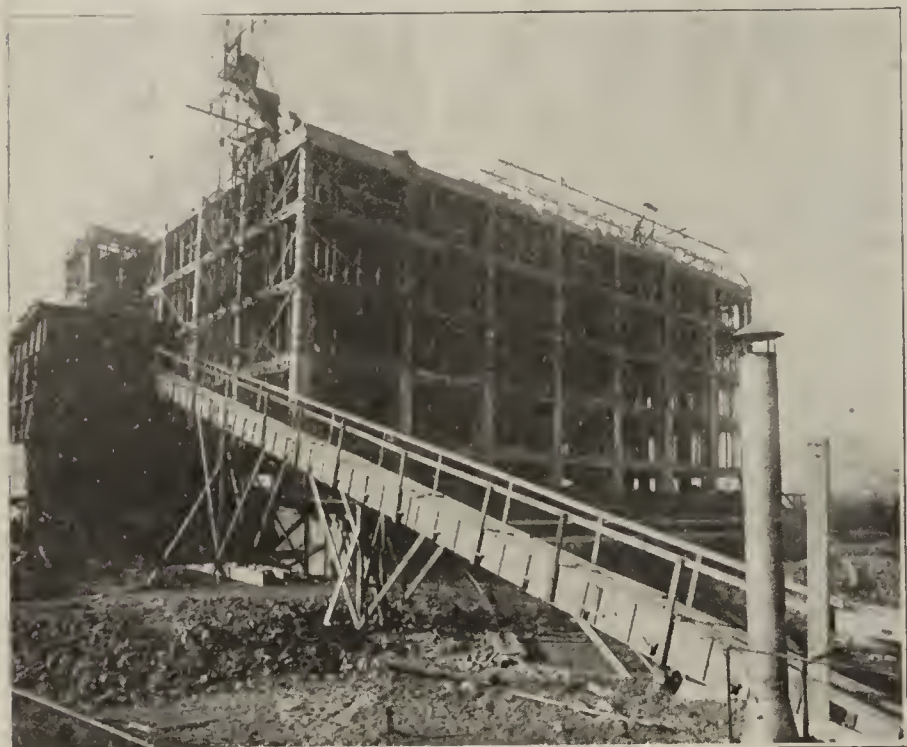


SOLD ON 15 DAYS' TRIAL

Contractor's Conveyor for Use in Concrete Building Construction

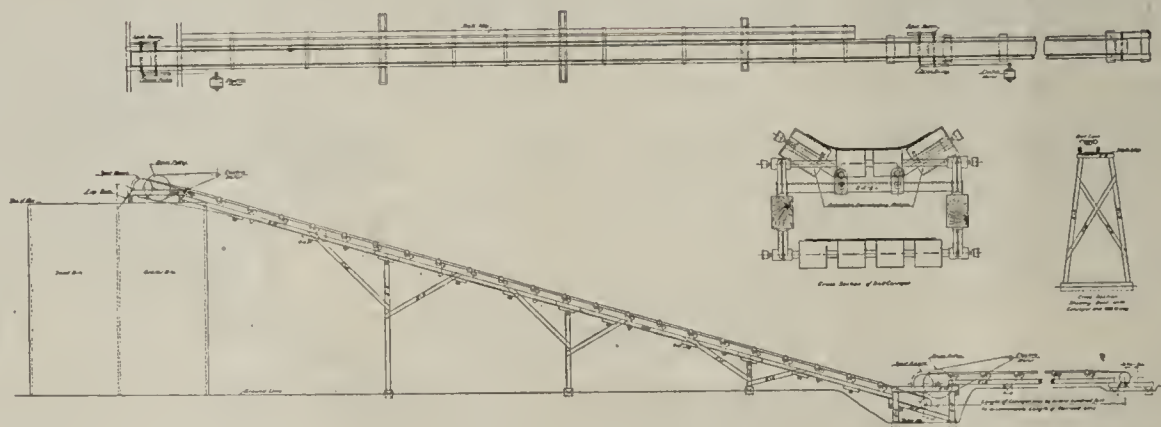
The handling of building material such as sand, gravel and crushed stone economically has always been a problem. In the illustration herewith is shown a belt conveyor taking sand and gravel up at an incline and loading it into bins, directly above the concrete mixer.

Whenever there is space enough, this type of conveyor has many advantages, as you may have a train



Contractor's Conveyor for Use in Concrete Building Construction.

of cars loaded with sand or crushed stone that you can unload onto the conveyor at the same time, without moving the cars.



Detail Plan of Conveyor.

The reproduction of the detail plan also shown herewith is one section of conveyors that are now being built for the E. W. Sproul Co., 1120 West Thirty-fifth street, Chicago. There is one section (a horizontal and an incline) on each side of the bins to supply sand and crushed stone for the building of the new Montgomery Ward warehouses at Thirty-ninth and Robey streets, Chicago.

This type of conveyor is also extremely inexpensive in operation. In the plant shown in the illustration a $7\frac{1}{2}$ h. p. motor is carrying the material about 300 feet, the horizontal part is about 200 feet long and the incline part is about 100 feet long, lifting it 35 feet up into the bins. Note the large roller carriers under the belts eliminating practically all friction, also the concentrating rollers which are easily adjusted for

more or less troughing in the belt as the need may be.

All the bearings are babbitted and are fitted with compression grease cups which will keep out sand and grit from the bearings.

The entire plant with machinery and structure can easily be moved from one location to another. For further information and prices write the manufacturers, Samuel Olson and Company, engineers, manufacturers and contractors, 2418 Bloomingdale avenue, Chicago, Ill.

Cost of Quarrying With Special Explosives

A quarry of the Colorado Portland Cement Co. has layers of limestone from 6 to 28 inches thick, separated by 6 or 8-inch layers of shale, all with horizontal stratification and a quarry face from 40 to 50 feet high. The 44 vertical holes, $5\frac{5}{8}$ inches in diameter, were drilled 2 feet below the quarry floor by a cable drill operated by an electric motor. The holes were drilled 20 feet apart in three rows, the first row being 20 feet from the face of the second and third rows, 18 and 36 feet farther back. Each hole was charged with 265 to 425 pounds of Monobel No. 6 explosive and was primed with two No. 7 DuPont electric blasting caps. The holes were tamped with sand and one set of caps was connected in series and the other in parallel. The blast broke 61,182 tons of rock, about 30,200 yards, at a total cost of \$2,178. The cost of drilling was \$262 for labor, and \$24 for power, for a total of 2,094 feet of holes. 14,850 pounds of powder was used and broke 4 tons of rock per pound. Superintendent Frank E. Walters wrote to the *DuPont Magazine* that the charge of powder in the first row was about $2\frac{1}{4}$ yards of stone per pound and in the rear rows 2 yards of stone per pound.

Orders For Traylor Crushers

The Chicago branch of the Traylor Engineering & Manufacturing Company, L. J. Hewes, manager, reports recent orders for jaw crushers, as follows; 56x86 inches, for the General Crushed Stone Company, Easton, Pa., for their newly acquired Little Falls, N. Y., quarry, 48x60 inches, for the Sandusky Cement Company, for their Dixon, Ill., plant. 36x72 inches, for the Oklahoma Cement Company, for their Ada, Okla., plant. 36x72 inches, for the Three Forks Portland Cement Company, Denver, Colo. 60x84 inches, for the Hydro-Electric Power Commission of Ontario (Toronto) to be used in large crushing plant for their new 200,000 horsepower Niagara development. 66x86 inches, for the Missouri Metals Corporation at Mine La Motte, Mo., for its new 10,000-ton milling plant.

CORRECT SYSTEM SILOS

Caldwell Silos meet every demand

WHY the constant re-orders from farmers for Caldwell Stave Silos throughout the country?

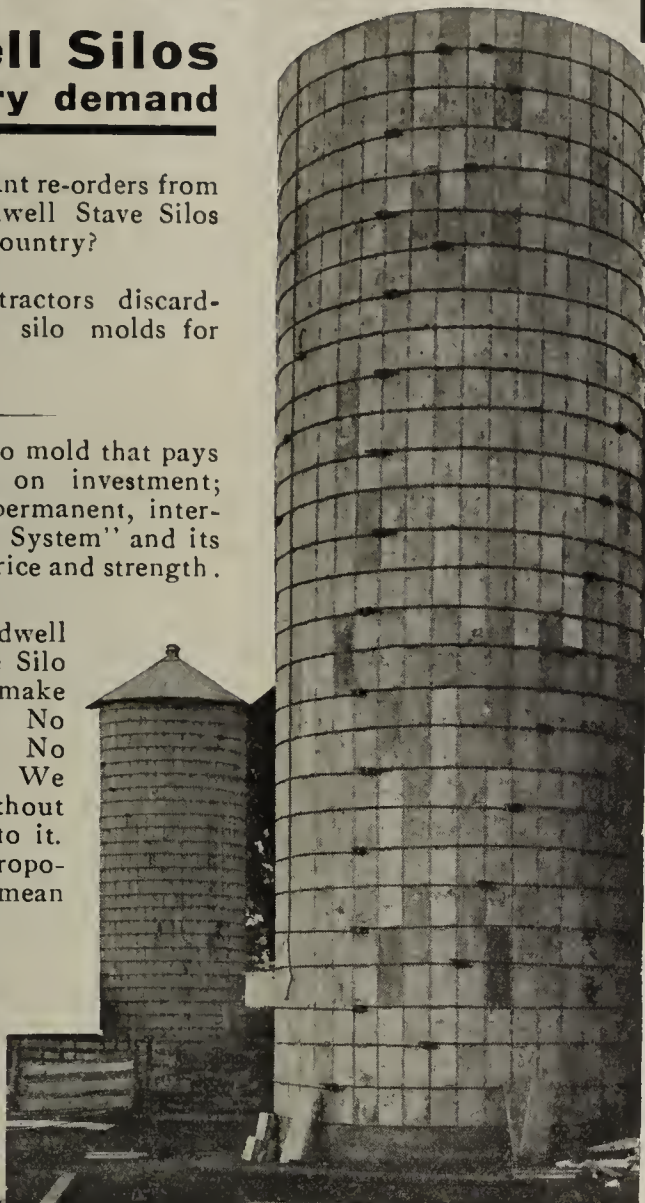
WHY are contractors discarding other stave silo molds for Caldwell's?

BECAUSE it's —

the only stave silo mold that pays large dividends on investment; because of its permanent, interlocking "Correct System" and its simplicity, low price and strength.

Buy a set of Caldwell molds and make Silo Staves as you make building blocks. No royalty to pay. No territory to buy. We sell the outfit without strings attached to it. This is a good proposition and it will mean money to you.

Co-operative
Concrete
Construction Co.
OSKALOOSA, IOWA



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BIG JOBS

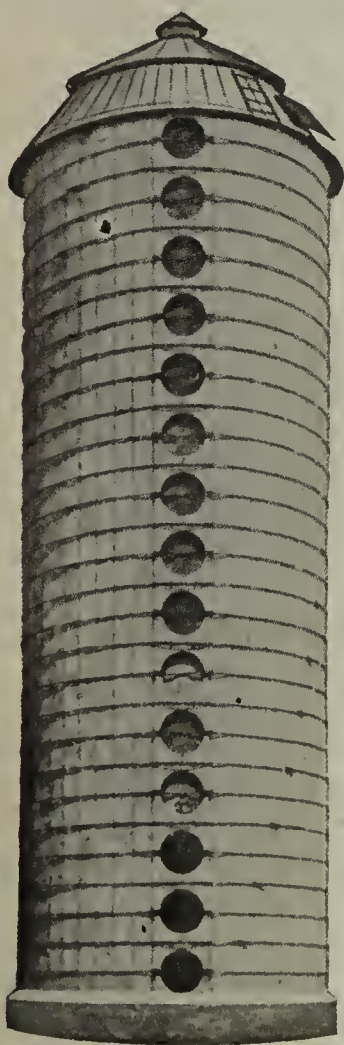
Big jobs come to the man who is ready to handle them. YOU can get ready (at very low cost) for the construction of concrete grain storage, water tanks, coal pockets, silo-water tanks, and silos. The POLK SYSTEM machine builds all kinds of monolithic circular work in a way that pleases everybody. Excellent workmanship — low cost of operation — big profits — ever growing business — big jobs. Shall we send a catalogue?

Polk Genung Polk Company

Fort Branch

Indiana

2nd Floor, Insurance Exchange Bldg.
175 W. Jackson Blvd. CHICAGO



YOU will recognize this Cement Stave Silo is built with Pierce Round Steel Doors. These doors are rapidly eliminating wood doors, also spreaders which frame the opening in an ungainly, awkward manner.

ABSOLUTELY FIRE-PROOF.

Simple, effective arrangement provided to fasten rod at door frame.

WRITE FOR DETAILS AND PRICES. It is never too late to improve your silo. No extra equipment required than you are using.

Ask for literature and prices on galvanized roofs, chutes and ladder.

We are largest distributors of silo rods and lugs in the United States.

All inquiries given prompt attention.

THE PIERCE COMPANY
1101 Waldheim Bldg. KANSAS CITY, MO

Oil Engine Operates Sand Pumping Plant

Illustrations on this page show the sand pumping plant of the Platte Gravel Company at Cedar Creek, Nebraska, on the Platte river. A 50-h. p. oil engine operates a rotary sand pump, both of which are mounted upon a scow. A suction pipe leads from the sand pump to the bottom of the river from where the sand is picked up and carried to the top of a head-frame, where the sand, gravel and water are thrown against a screen.

The size of the gravel allowed to pass through with the sand is determined by the size of the screen mesh. Having passed through the screen, the sand is promptly loaded into railroad cars, the water returning to the river.

The engine has been in operation since the latter part of March, and in continuous operation during the summer season without even a roof placed over it, or any protection whatever from the weather.

The outfit is in operation on an average of fourteen hours per day, is looked after by workmen having no engineering experience and no repairs have been required.

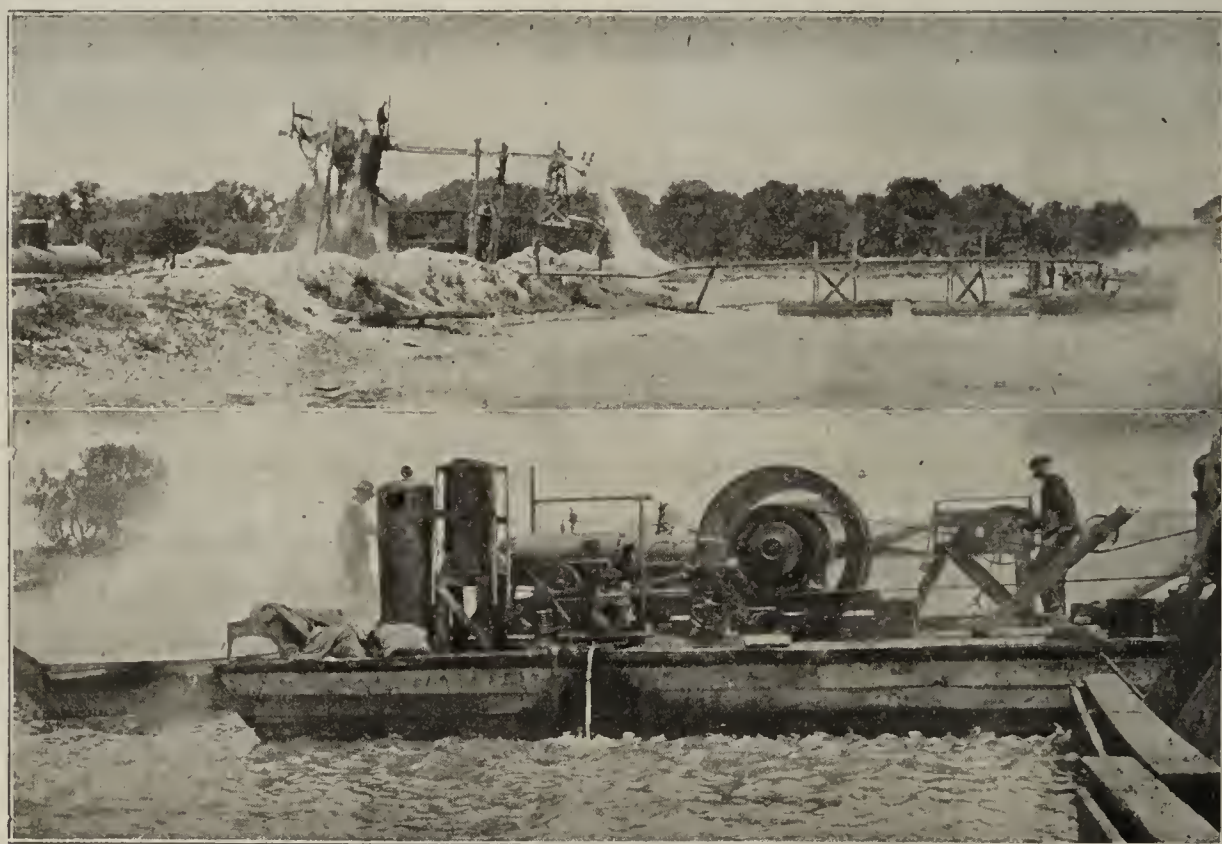
The owners are so well pleased with the performance of the plant that they have placed an order with the Chicago Pneumatic Tool Company for another oil engine—one of 100-h. p., to be mounted upon a larger scow for service during the coming season.

tion in all lines of manufacture. The personnel of the membership comprises men who by reason of the fact that they represent companies making one of the most important items used in automobile construction, may well be said to have been the means of placing the automobile industry in its present pre-eminent position.

The officers of the association are: F. W. Sinram, Van Dorn & Dutton Company, Cleveland, president; H. E. Eberhardt, Newark Gear Cutting Machine Company, Newark, N. J., vice-president; F. D. Hamlin, Earle Gear & Machine Company, Philadelphia, secretary, and Frank Horsburgh, Horsburgh & Scott, Cleveland, treasurer.

The convention was opened Monday, May 14th, by F. W. Sinram, president, and the morning devoted to an executive session. In the afternoon, S. L. Nicholson, sales manager of the Westinghouse Electric & Mfg. Company, spoke on "The Ins and Outs of an Industrial Organization," and James E. Gleason presented a paper on "The Spiral or Curved Tooth Bevel Gear." On the following morning papers were presented by Frank Burgess on "Job Gearing—to What Extent Can It Be Standardized?" and by Wm. Ganschow on "Advantages of Gear Standardization." In the afternoon, George L. Markland discussed the "Difficulties of Gear Standardization."

The entertainment features included an informal dinner at the Hotel Schenley followed by dancing, automobile trips and a theater party for the ladies, and a bowling contest at the Pittsburgh Athletic Association.



Top. Sand Pumping Plant Operated by the Platte Gravel Co. of Cedar Creek, Neb.
Bottom. Oil Engine Operating Sand Pump for Platte Gravel Co.

American Gear Manufacturers Association Convention

The recently organized American Gear Manufacturers Association held its first convention at the Hotel Schenley, Pittsburgh, Pa., on May 14th and 15th. An interesting program was arranged and elaborate preparations made by the Pittsburgh members for entertaining the visiting manufacturers.

The association has been organized for the purpose of developing, standardizing and improving all products of the gear industry. In view of the present national situation this convention will undoubtedly have a very important bearing on the efforts being put forth by the government for absolute standardiza-

On Tuesday afternoon the delegates visited the works of the Westinghouse Electric & Mfg. Company at East Pittsburgh, Pa., where they witnessed methods of manufacturing Bakelite Micarta for gears, after which they were the guests of the Westinghouse Company at a dinner in the club rooms of the Pittsburgh Athletic Association.

Road Roller

The Austin Western Road Machinery Co. of Chicago, calls attention to a new Tandem Road Roller, motor operated, in a folder describing and illustrating it in detail. Their New York address is changed from 30 Church street to 50 Church street.

The Roof for All Time

Start a
"Concretile"
Plant



The Greatest
Opportunity in the
Construction Field

The most economical, attractive, permanent fireproof roofing in existence. A standard roofing in Germany for more than 25 years.

The manufacture of Walter Concretile is now a national industry in this country. Within the last eighteen months large plants have been established in many of the leading cities. All operating plants have business booked ahead—the demand is universal.

We Do Not Sell Blue Sky

We sell complete equipment for starting business. We protect you in the territory by establishing only one plant in a locality.

Send today for free booklet giving full information.

Walter Concrete Machinery Company

418 Saks Building

State Representatives Wanted

Indianapolis, Ind., U. S. A.

The Multiplex Double Stripper Block Machine makes two Hollow Plain or Rock Faced Block of Wet Mixture at ONE OPERATION



Here is a machine that cuts down the cost of making your building block. In making plain faced block the machine handles a wet mixture and stripping the block out it trowels the sides. The wet mixture compacted under pressure from *both top and bottom*, produces a strong waterproof block which is easily cured. A 150-lb. man on the end of the lever will exert a 40-ton pressure on the block. Two men will make from 700 to 800 blocks per day on this machine.

Write for our latest printed matter explaining the operation of this labor-saving machine in detail

Write for catalog No. 10 and mention Cement News
The Multiplex Concrete Machinery Co., Elmore, Ohio

Same Machine Makes Chimney Block

The Multiplex Stripper may be equipped for manufacturing chimney block as well as building block. Note the flue block shown here with the round smoke chamber in the center, the ventilating chambers in the corners and the tongue and groove joints insuring rigid construction. There is money in the manufacture of chimney blocks alone.



Handling Gravel With Loading Machine

A large saving in the cost of handling gravel has been effected by the Goodyear Tire & Rubber Co. by the use of a wagon loader. The comparative test of this work by hand labor and by the use of the loading device showed the following results:

Hand labor.	Cost.
Loading wagons, 8 laborers, 3 yds., 13.00 min. @ \$0.25.....	\$.435
Loading auto truck, 8 laborers, 2½ yds., 10.00 min. @ \$0.25.....	



Haiss Digging Wagon Loader.

min. @ \$0.25.....	.415
Cost of auto truck @ \$1.00 per hour.....	.160
Cost per 5½ yds.....	\$1.010

Cost per yd.....	.184
Wagon loader.	
Loading wagons, 2 laborers, 3 yds., 4.8 min. @ \$0.25	.040
Loading auto truck, 2 laborers, 2½ yds., 4.0 min. @ \$0.25.....	.033
Cost of auto truck @ \$1.00 per hour.....	.066
Power @ ½ ct. per cu. yd.....	.028
Oil, grease, interest on investment.....	.010
Cost per 5½ yds.....	\$0.177
Cost per yd.....	.032
Cost per yard hand labor.....	.184
Cost per yard machine.....	.032

Amount saved per yard.....\$0.152

The above saving is entirely exclusive of supervision and overhead charges. The machine used in this test was the Haiss Digging Wagon Loader, which is manufactured by the George W. Haiss Mfg. Co., 143d street and Canal Place, New York City.

Western Manager Appointed

The Stroh Steel-Hardening Process Company, of Pittsburgh, is arranging for a greater scope of activities, one evidence of which has been the appointment of a western sales manager for the central and near western states.

Mr. F. Lloyd Mark has been appointed to this position, with offices at 728 Monadnock block, Chicago.

The processed steel castings made by this company furnish a wear-resistance steel of the highest quality and are used largely in cement plants.

QUICK DELIVERIES ON



BUILT OF STEEL
PAVERS

8-11-15 Foot Sizes
(Non-tip High Drum Type)

AND
BUILDING MIXERS

(5-8-11-15-22 Foot Sizes)
Get Our Astonishingly Low Prices
Write nearest Office

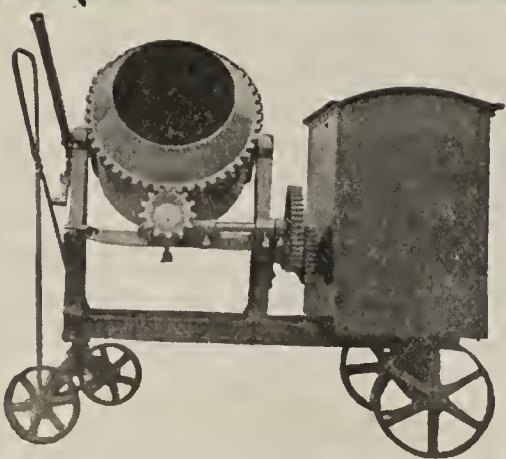
The American Cement Machine Co. Inc.

Keokuk Iowa
THE 300,000 HP ELECTRIC CITY

BRANCH OFFICES—New York, Philadelphia, Pittsburgh, Baltimore, Richmond, Cambridge, Mass.; Indianapolis, Chicago, New Orleans, Minneapolis, Seattle, Spokane, Los Angeles, San Francisco, Cleveland, St. Louis, Louisville.

Mixers Pavers Grouters Hoists

Republic "3" America's Greatest Small Mixer



\$50 and up

—
Hand or Power

—
Cash or Time

A Real Builder's Outfit
At a Real Low Price

Will mix concrete or mortar, and anything from a very wet to a very dry mix—fine for blocks, brick, tile, sidewalk, curb, gutter, floors, foundations, brick mortar, etc.

So light a couple of men can move it most anywhere—yet strong enough to stand hard usage.

Just the right size and weight for builders, small contractors and block plants and sold at prices you can afford to pay.

Manufacturers of All Sizes and Types

Write for complete information.

THE REPUBLIC IRON WORKS

Box 454 or 116 Patterson St.

Tecumseh, Mich.

Charles A. Schieren Co. Leather Belting

The Schieren tanneries and processes of making leather belts, as well as the proper methods of cutting and lacing belting and of taking care of the belts are described and illustrated in a forty-page catalogue, handsomely gotten up, by the Schieren Company, Ferry street, New York. A study of this publication will enable the engineer to save time and money.

Cement Company Prospers

The Newaygo Portland Cement Company, Newaygo, Mich., has declared a stock dividend of approximately 100 per cent. The company reorganized some years ago when \$1,000,000 bonds and \$2,000,000 stock were outstanding, the bonds being wiped out and the stock reduced to \$500,000. Through this dividend a portion of what was originally marked off is being restored to stockholders.

Concrete Alleys

Instructions have been given the Los Angeles Board of Public Works by the City Council to have all alleys in the future paved with concrete. The city engineer had reported that bituminous material for paving is unsatisfactory in alleys, and also said that if concrete had been used in the alley paving done last year, the city would have saved 22.7 per cent in first cost.



The
**Rugged
Ruggles**

**AERIAL
CARRIER**

Suspended over Slate Quarry

**SELF DUMP
BRAKE LOCK ING**

Built in Two Sizes:—1 to 5 tons capacity, 5 to 10 tons capacity.

The **Rugged Ruggles** is made for special use on cement and gravel construction work. For all kinds of quarries where the waste is taken from the pit and dumped at the surface. It will take any load up to ten tons, from any depth to the cable, where it is automatically released and sent either up or down the cable and dumped in mid-air or lowered. One man can operate three **Rugged Ruggles** on as many cables with a three-drum engine:

No brake to wear the cable—Can run on a flat cable.

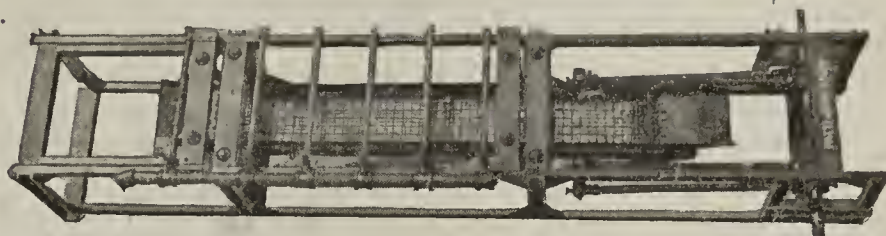
Simple in construction; made entirely of steel; all the sheaves steel bushed or brass, and is backed by years of extensive use.

Manufactured by

Ruggles Machine Co., POULTNEY VERMONT Dept. C

New Shaker Gravel Screen Is Compact

The compact shaker sand-and-gravel screen, 18 feet long, 3 feet 2 inches wide and 3 feet 8 inches high, shown on this page, has a daily capacity of 400 cubic yards. It is of steel construction, self-contained and readily portable, as it weighs but 3,600 pounds equipped with the spray washer. The top, of 2-inch mesh, takes the over size; the second is of $\frac{3}{4}$ -inch mesh; the third mesh is 4 per inch and is for roofing gravel; the fourth is 10 mesh for torpedo sand; and the last, of 24 mesh, takes fine sand. The screens, which are made in 400 and 600-yard units by the Excavating and Screening Machinery Co., 748 Security Bldg., Minneapolis, operate at approximately one-half cent per yard for power.



The Shaker Screen of No Regrets

SAVES—

High Cost of Installation.

Wasted Floor Space, Unnecessary Height.

Excessive Horse Power, Large Supply of Water.

BECAUSE—

Machine is Self Contained and Very Compact.

Large or Small Capacities for Washing or Dry Screening Plants

Send for Catalog "B"

Excavating & Screening Machinery Co.

748 Security Building

Minneapolis

Minnesota

CEMENT BLOCK MACHINE

**SOLD ON
15 DAYS' TRIAL**

**Large Capacity
—Small Price**



The Dunn has a capacity of 150 blocks a day—ample for average requirements. Simplifies block making; remarkably easy to operate; makes a wide range of sizes; built rugged to stand hard service. Write for Block Machine Bulletin.

W. E. Dunn Mfg. Co.

414 24th St. Holland, Mich.

Growing Products Plant at Joliet

One of the most modern and complete concrete products plants in the Middle West is that of the Ideal Concrete Construction Company, located on the outskirts of Joliet, Illinois. The company not only manufactures practically every kind of concrete product at the plant, but is also engaged in the concrete contracting business, doing a considerable amount of bridge and building work in the vicinity of Joliet.

The plant is conveniently located on a double-track industrial spur of the Michigan Central Railroad. Just across the street is the extensive quarry belonging to this railroad. Formerly the crushed stone used in the plant was obtained from this source, but the quarry is not now in operation and the materials are elsewhere obtained.

The main building of the plant is of concrete blocks, both rock faced and plain beveled-edge blocks being used, while one wall has been plastered over and rough cast. This building is divided into two rooms, the front one about 30x60 feet in dimensions, the rear one about 40x75 feet. The front room is devoted largely to the manufacture of concrete burial vaults, of which the plant makes a specialty. The forms for making the burial vaults were furnished by the Automatic Sealing Vault Company, 216 E. River St., Peru, Ind.

In this front room is also a chimney block machine furnished by the Multiplex Concrete Machinery Co., Box No. 10, Elmore, Ohio, for making concrete chimney flue blocks with a surrounding air chamber. A row of wooden shelves in one corner holds a large number of metal molds for various ornamental and architectural shapes. Among them are Ideal molds for spherical column caps and an Ideal column block mold made by the Ideal Concrete Machinery Co., 1353 Monmouth Ave., Cincinnati.

In the center of the room is a large jacketed stove for heating the plant in winter. The space surrounding this is also devoted to hand work. Here round columns are being made in an Ideal column mold. An Ideal block machine is used for the making of odd shapes and styles of block of which no large quantity is desired. Small twisted square rods and triangle mesh are on hand for reinforcing purposes.

The power-operated machinery is located in the rear room, which is an addition to the original plant. Power is supplied by a gasoline engine furnished by the Thompson Engine Works, Beloit, Wis. This engine is belt connected to an overhead shaft, from which belts run to the various machines in the plant. One operates a small pump in a little room outside one corner of the main room. This pump elevates water from a well to a rectangular tank on the roof, from which the water supply for the plant is piped.

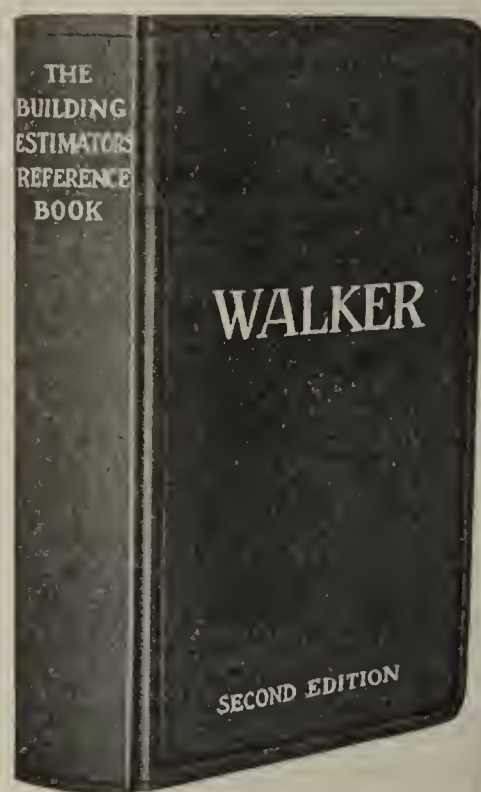
Concrete blocks are here made on an Ideal block machine equipped with an Ideal automatic tamper. The machine is a face-down machine, equipped with plates for making various plain face, beveled, rock face and rubble blocks, in full sizes and in fractional sections. Concrete is mixed in an adjoining Ideal type B No. 1 batch mixer. This machine is of the open type, with blades that shovel the materials in a semicircular trough. The plant is equipped with a large number of iron pallets for the blocks. The finished blocks are placed in rows along the inner walls of the building, wooden blocks being placed at the end of each row and a plank placed across them, allowing several rows of blocks to be placed one above the other.

Near the block machine and mixer is a Dunn No. 1 tile machine, equipped for making all sizes of drain tile from 3 to 12 inches in diameter.

New Publications

The Building Estimator's Reference Book. By Frank R. Walker. 3535 pages, size 5x7 in. Illustrated. Bound in flexible cloth. Published by Frank R. Walker. Price, \$5.00. Sent on receipt of price by Cement & Engineering News, Transportation Bldg., Chicago.

The estimator who computes the approximate cost of a modern building must necessarily eliminate guesswork as far as possible, and one of the best means of doing this is by an examination of the data which has been compiled by men thoroughly familiar with the subject. An excellent aid to this end is to be found in the book under review, it being the second edition of a work which has been thoroughly revised in order to take care of the radical changes in cost data that have occurred during



the past year. The costs given in the work are taken from reliable sources, as in most cases the author was on the work during construction and compiled all cost data during the progress of it. In other cases it was obtained from the actual cost sheets coming in from the job each week, and compiled at the completion of the work. Numerous illustrations, which include reproductions of photographs and line drawings, are given. The half-tone engravings were reproduced from photographs taken during the progress of the construction so as to show actual conditions existing on the job, thus illustrating the methods and plant employed, from which the labor cost on the branches of work resulted.

The book covers the subject very thoroughly, the matters treated including estimating upon overhead expense, excavating, concrete for footings and foundations, water and damp proofing, reinforced concrete construction, brick masonry, rubble stone work, cut stone, granite, architectural terra cotta, hollow tile fireproofing, carpentry, mill work, lathing, plastering, various branches of sheet metal work, painting and varnishing, hardware, plumbing, heating, electric wiring, sprinkler systems, etc.

A large stone, weighing hundreds of pounds, in the quarry of the Standard Lime Co. at Quarry, Wis., became dislodged and in rolling pinned Peter Bracdale, age 23, under it while he was at work near by. He was brought on a special train to a Manitowoc, Wis., hospital in a precarious condition and may not survive his injuries.

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300,000-bushel Concrete Elevator Just Completed at Louisville

Link Belt Company's New Concrete Factory

The reinforced concrete factory building constructed at Indianapolis, Indiana, for the Link Belt Company is distinctively characteristic of what may be secured by the use of reinforced concrete. There are three stories, each 14 feet high; the over-all dimensions of the building are 422 feet 6 inches by 100 feet; the floor area, including the loading platform and pent house floor, is 128,860 square feet. The building is to be used for the manufacture of malleable iron chains by the owners. It was constructed by the C. R. Pease Construction Company, of Indianapolis, and was designed by Jas. B. Steep, 918 Majestic building, Indianapolis. An accompanying photograph shows the building as completed. The peculiar shape was necessary in order to conveniently fit the building to the railroad tracks.

The foundations did not present much difficulty until one end of the building was reached, at which

which make it extremely interesting to the contractor who specialize in this kind of work and to the tractors who contemplate entering this field.

Quick Work

The first interesting feature is the speed with this building was erected. The building was contracted to be completed in four months. The reason for the job being completed in this time, despite the unanticipated encountering of quicksand at the foundations, was due principally to the arrangements made for delivery and handling of the material. In all there were 344 cars of materials handled, averaging an average of 86 per month. In no case was any of the work held up due to poor deliveries of material, with the exception of the steel sash shipments. The delay on this material was due mainly to the fact that the owners purchased the material and could not secure as prompt a delivery as was expected. In



Photograph of the Link Belt Company's reinforced concrete factory, erected in four months in spite of foundation difficulties, on a cost-plus-percentage basis. This concrete building cost far less than steel construction and about the same as mill construction. In addition it is fireproof, permanent and will require little or no maintenance.

point a soil very similar to quick-sand was encountered. This necessitated that about fourteen of the concrete piers and footings be carried down to a depth varying between 20 and 32 feet. Sheet piling, consisting of wood plank 2 by 12 inches, was driven and the pier area excavated. The excavation was carried in each case to a depth at which good, firm footing was secured. In some cases the foundations were carried to a firm sand at a depth of 3 feet.

The concrete used in the building was all of a mixture of 1 part cement, 2 parts sand and 4 parts gravel, 12,000 barrels of Atlas Portland cement being used. The interior columns, as usual, varied in size, those for the first story being 21 inches square, those for the second story, 18 inches square, and those of the third story 15 inches square. Similarly with the exterior columns, those for the first story were 19½ inches by 21 inches, and those for the second and third stories were 15 inches by 19½ inches. The beam and girder type of floor construction was used, as can be seen from an accompanying photograph showing the interior of the job. The floor slabs were reinforced in one way only.

There are many unusual features about this job

all there were three distinct concrete plants, there being, of course, three cement sheds and three aggregate storing places to supply these units. No one supply for any plant was allowed to diminish too rapidly, and this also contributed toward the completion of the construction on specified time. As soon as a car of sand or gravel came in it was put on the siding shown in the picture in front of the building and dumped either side of the track at a convenient distance from the concrete plant and tower. In this way the hauls for the different materials were kept at a minimum.

Steel Forms Used

Another feature of this building was the forms used. It was found that the use of dome steel forms would be considerably cheaper than wooden forms. An accompanying photograph illustrates how these forms were fixed in place before the concrete was poured. Each dome was placed upon two wooden stringers, reinforcement being carried a little above these stringers in the proper place in the beam. After this work was completed an entire section of the floor was poured. After a period of about two weeks the steel forms were taken out from under the slab. The con-



Steel Dome Forms were found to be considerably cheaper than wooden forms. Each dome was placed upon two wooden stringers, the reinforcement being carried a little above the stringers in the proper place in the beam.



View of the Interior of the Link Belt Company's Building, Showing the Beam and Girder Construction, the Small Columns and the Flood of Daylight



Photograph of the Link Belt Company job during construction. Note the three concrete hoist towers instead of one, for sake of speed and economy. Note also that the materials were run right in along the building on the sides and dumped to best advantage considering the locations of the hoists.

crete slabs were then reshored and left supported for thirty days. At the end of this period the floor above had been poured about one week. In this way a good portion of the steel domes were used over and over, some being used three times. The contractor advised that these forms were used on another job, but were permitted to remain in the floor on that work. The contractor's figures show that steel forms proved very economical as compared with wooden forms. It would be interesting at this point to mention the method of procedure for pouring a whole floor. As already stated, there were three concrete towers. After the forms had been placed for one section one tower supplied the concrete for that area until the concreting had progressed to a point at which the second tower could more advantageously supply the concrete. This tower then supplied that section of the floor until such a point was reached at which the third tower could more conveniently supply the concrete. In this manner, only one concrete tower was being used at any particular time; the others were kept supplied with material so that they could be put into operation as soon as the concreting had progressed sufficiently so as to call them into use. All three floors were poured in this manner and by progressive pouring from each of the towers.

The floors of the building were designed to withstand a floor load of 200 pounds per square foot live load, with a guarantee that each floor would withstand a test of 400 pounds per square foot. This guarantee necessitated a floor test.

It is interesting to note why reinforced concrete was chosen as the type of construction for this building:

- (1) It was found that concrete was cheaper than slow-burning mill construction. One contractor's figures for slow-burning mill construction was \$500 more than for reinforced concrete.
- (2) More light and better ventilation were secured.
- (3) It was possible to use smaller exterior columns in reinforced concrete than in slow-burning mill construction, and this, of course, gave greater window area.

The contract was awarded on a cost plus fixed sum basis. It has been estimated, however, that the entire cost of the building, including all service equipment, but excluding a small amount of painting and exterior brick paving (amounting to a total of \$600) was \$1.12 per square foot. The entire work cost in the neighborhood of \$145,000, including the service equipment. These costs show one reason why reinforced concrete is being adopted more and more for industrial buildings, and the trend of events tend to indicate that there is a big field for the contractor in this type of construction.

Shortage of Labor Becoming More Acute—Labor Savers in Demand

The world today is in need of men. Not alone for war purposes, but for business and industrial conditions. Millions of mechanics and laborers are required to run the world's machinery. With all the available men of the fighting European countries enlisted in military services and drafting soon to begin in our country, means are being sought whereby work can be done with less men. In farming and industrial work dynamite is being used as a substitute.

Really, without explosives we would be in a bad predicament. The extent to which high explosives can be used is certainly amazing. They are used practically all over the world for subsoiling, tree planting and land draining.

Fruit growers are high in their praise for dynamite. It prepares the ground for planting orchards so that the roots of the trees may reach far into the loosened earth, and thrive properly. Rain sinks into the mellowed subsoil and there serves its nourishing purposes for weeks after the top soil has become dry.

Dynamite is used extensively as a labor-saver for digging trenches, canals and ditches. In road building, especially where heavy grades are to be cut down, explosives do the work of many men.

Columns could be written on the employment of explosives for business purposes and its aid to all great constructive work. But briefly it is a labor-saver when used for the following purposes, in addition to the previously mentioned—draining swamps, blasting holes for telegraph and telephone line poles, straightening streams by blasting new channels, wrecking old buildings, bridge piers, and stone walls, blowing down clay in brick yards, breaking up frozen ore on ground or in open cars, and loosening ground for sewer excavations. While this last use may be considered dangerous, it is being accomplished without danger to the public or to underground pipes.

High-Class Concrete Specialties

The Art Stone Company, Waynesboro, Pa., are successful manufacturers in concrete marble making and in a great variety of decorative concrete work.

The illustrations shown in their catalog give an idea of the artistic possibilities of concrete for exterior and interior use, such as exterior trim, porch work, lawn and garden accessories, floor, wainscot, mouldings, table tops, bank and store counters, bases, for show cases, interior fireproof trim, etc., over 100 styles being shown.

By their formulas, processes and methods it is possible to imitate any marble, granite or onyx, from a pure white to all the various shades and colors desired, at a cost of about one-fourth that of the natural marble. Coloring is used in the facing surface only, which is permanent and will not fade, and takes a polished finish direct from the molds, while the body of tile is of cement.

The results obtained are certainly remarkable, and any one interested in the manufacture of concrete of this character should not fail to write the Art Stone Co., Box 330, Waynesboro, Pa., for descriptive literature.

New Concrete Elevator in Louisville

The new plant of the W. A. Thomson Company, grain dealers and elevator operators of Louisville, recently completed, is believed to be the last word in fireproof or fire-resisting construction. The plant is constructed entirely of concrete and steel, and steel reinforcing, and not a stick of wood is used in its entire construction. All window casings, doors, floors and other sections of the plant are of either metal or concrete.

The capacity of the Thomson elevator is 300,000 bushels, divided into twenty-eight concrete bins, equipped with all modern conveying and elevating machinery and arranged to load and unload from and to cars from both sides of the plant, which is electrically operated throughout.

The dimensions of the plant are $44\frac{1}{2} \times 128$ feet, the largest bins being 19 feet in diameter, while the interstice bins run much less. All of these bins are 85 feet high, while the conveyor-room overhead is 10 feet in height. The workroom runs 45 feet higher than the bins, or 130 feet from the ground. A total of 2,500 yards of concrete was poured on the work.

Plans were drawn by Janse Bros., Boomer, Crain & Howe of Detroit, Mich., who also handled the general contract. J. J. Gaffney of Louisville had the cement work.

The company is planning to increase its capacity by 300,000 bushels but has postponed the work on account of the present high cost of material, and may not go ahead until after the war.

The Westinghouse Electric & Mfg. Company Elects New Officers—Declares Red Cross Dividend

At the regular meeting of the Board of Directors of the Westinghouse Electric & Manufacturing Company held in New York on Wednesday, June 20th, an extra dividend of $\frac{1}{2}$ of 1% on both common and preferred stock was declared for the benefit of the Red Cross fund. This dividend, which will amount to approximately \$375,000, is an addition to the regular quarterly dividend of $1\frac{3}{4}$ % on both common and preferred stock, which was also declared.

At this meeting the annual election of officers of the company was held.

Chairman of the Board Guy E. Tripp, President E. M. Herr, Vice Presidents L. A. Osborne, Chas. A. Terry and H. P. Davis, Acting Vice President T. P. Gaylord, Comptroller and Secretary James C. Bennett, Assistant Secretary W. H. Jones, Assistant Treasurer and Assistant Secretary S. H. Anderson, Auditor F. E. Craig, and Assistant Auditor W. B. Covil were re-elected to their respective offices. Three new vice presidential offices were created, and the following were elected to fill same: Henry D. Shute and Herbert T. Herr, both of Pittsburgh, and Walter Cary, of New York. H. F. Baetz, assistant treasurer, was elected to succeed Mr. Shute in the position of treasurer. L. W. Lyons was elected assistant treasurer to succeed Mr. Baetz and W. J. Patterson was elected to the newly-created position of assistant auditor.

Dust Collecting and Ventilating In Factories

Abstract of an Address delivered by W. G. Clark, President of the Clark Dust Collecting Company, Chicago, before the Illinois Manufacturers Association and the National Safety Council

When I was asked by your committee to speak on the subject of Ventilating and Dust Elimination and Collecting in Factories I felt reluctant and somewhat timid in accepting, for several reasons; first, because I am not a public speaker, being more of a practical man, and, second, I was afraid some might think I had an ax to grind (being in this business), but I was assured by them that this would not be the case, and that this Association wanted a good practical talk on this very important question, and that no one could do the matter justice better than one directly engaged in solving problems of this kind. With this understanding, I propose to present to you, therefore, in the best and shortest manner, a few facts and fancies pertaining to handling air problems and their application to the subjects of Dust Elimination and Dust Collection, and General Ventilation. These three points of my subject are so near alike that they come under practically one head, as to the manner of solution and consideration. And I will also try to prove that this subject is *justly entitled* to be placed with and classed as one of the many phases of the safety first movement, which we are all so directly interested in.

Any Dust is a menace to health. A well-known New York physician has said: "*Dust is man's worst enemy.*" And many accidents can be attributed to employes working in dusty atmosphere. The bad results of inhaling dust-laden air, of all kinds, are hard to correctly determine. I will give you a few facts and figures for your consideration.

I do not think there is any person present this evening that will dispute the fact that in a *well-ventilated factory* more efficiency, as to *quality* and *quantity* of work, can be secured than in one having none, or a **poor**, ventilation, nor can they successfully dispute the fact that the less Dust the better ventilation condition exists.

Dangerous Dust can be classified under three heads: Poisonous, explosive and irritating, all of which cause the loss of life, limb and property.

However, *any* Dust is injurious, more or less, to the health and life of employes compelled to work in same. No Dusty air is pure air, and pure air is necessary for good health. Industrial diseases and loss of time are often the direct results of impure air. "Safety First" should be the slogan of the wise manufacturer, and should apply to the sanitary condition of the plant as well as to safety appliances protecting life and limb, for: "A sick man at home is as helpless as an injured one, and oftentimes he is disabled from work for a longer period of time."

The firm owning and operating a plant in which Dust is floating around in the atmosphere should protect himself and employes in eliminating same, for the following reasons:

1st. It is always a source of revenue to himself, represented in material saved, also the better class of work obtained from the workmen, and the saving in wear and tear on surrounding machinery and property. He has also better protection from fire loss and explosion, and the loss of men's time due to sickness and disease caused by inhaling this impure Dusty air. Therefore, the investment of money represented in a good, practical Dust Collecting System is bound to bring him a large return on same.

Some Facts About Impure Air.

It breeds disease.

Dust carries deadly germs.

It affects the brain, lungs, eyes and causes headaches.

Every person should have at least 25 cubic feet of fresh air per minute.

The Board of Health of New York city, a few years ago, investigated the cause of mortality in their city and reported that "40 per cent of all deaths was caused by breathing impure air."

A report of carefully collected data proves that death rates have been reduced by introducing good ventilating and Dust collecting systems in Dusty plants, from 60 per cent to 5 per cent, and ventilation in prisons from 80 per cent to 9 per cent. In hospitals, from 44 per cent to 13 per cent.

One person in 10 in the United States dies of consumption in spite of the National war waged against it.

Fresh, pure air is indispensable to good health.

One prominent plant claims, since putting in a Dust collecting system, the *absence of employes from work* has been reduced 85 per cent; they also add that a better day's work was obtained from their employes, and more harmony and satisfaction among their men and women employes prevail. This plant is a well-known one in Chicago.

Men working in Dusty and impure air are slowly committing suicide.

It is hard to keep men at work in Dusty plants.

Changing employes and breaking in new men is unprofitable.

The only man I know of who profits by impure air is the undertaker.

Every pound of Dust saved is a source of revenue.

In the cement industry there is a great deal of interest being taken in solving Dust problems. There was a time when cement mills thought that Dust was unavoidable, and that it was part of their business to have a lot of Dust floating around, that it was part of the game; but in late years we notice a marked change in their opinion. Cement Dust is valuable. They spend hundreds and thousands of dollars in pulverizing and grinding machinery to pulverize their raw and finished material into a fine powder such as cement is, and they figure it is foolish to let it escape and get away from them in this condition. Therefore, they are putting in Dust Systems to reclaim this fine Dust. It reduces the cost of manufacture, and economical manufacturing of all products is looked after more carefully than in former years. They also figure that by eliminating the Dust the sanitary condition is so much improved that it pays to have this improvement, as they secure a better day's work from their employes, and save wear and tear on their machinery.

Appointed Superintendent Warrior Cement Plant

Mr. E. M. Confer, former superintendent of the Empire Cement & Limestone Co., of Atlanta, Ga., has been appointed superintendent of the Warrior Portland Cement Co., successors to Alabama Portland Cement & Lime Co., at Demopolis, Ala.

CEMENT AND ENGINEERING NEWS

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Advertising Rates Sent on Application

JOHN F. WALDRON - - - - - Advertising Manager

CHICAGO, JULY, 1917

Cement in 1916 Advance Statement of Final Figures

Complete statistics of the Portland cement industry in 1916 show that the shipments for that year, 94,552,296 barrels, valued at \$100,014,882, hold the record, and that the production, 91,521,198 barrels, is second only to that of the record year, 1913, when 92,097,131 barrels were manufactured. The stocks for 1915 have been revised slightly by the manufacturers.

Higher prices for cement prevailed throughout the United States in 1916, except at a few places where top prices were realized in 1915. The average factory price per barrel in bulk at mills was \$1.058, compared with \$0.860 in 1915, an increase of 19.8 cents, or 23 per cent.

The combined production of natural and puzzolan cements in 1916 was 842,137 barrels, valued at \$430,874, compared with 793,541 barrels, valued at \$398,428, in 1915.

These statistics, compiled by Ernest F. Burchard, of the U. S. Geological Survey, Department of the Interior, are based on returns from every active plant in the United States, and differ from the estimated figures, released January 1, 1917, by only 0.04 to 0.4 per cent.

Portland Cement Statistics by Commercial Districts, 1916.

	1915 (barrels)	1916 (barrels)	Change (per cent)	Av. factory price	
	1915	1916		1915	1916
Lehigh district (eastern Pennsylvania and western New Jersey):					
Shipments ...	24,598,950	25,360,287	+ 3.1	\$0.699	\$0.905
Production ..	24,876,442	24,105,381	— 3.1	....	....
Stock	3,400,936	2,156,825	—36.6		
New York:					
Shipments ...	5,275,101	5,603,477	+ 6.2	.766	1.027
Production ...	5,043,889	5,643,677	+11.9		
Stock	729,436	787,532	+ 8.0		
Ohio and western Pennsylvania:					
Shipments ...	7,528,383	8,123,492	+ 7.9	.855	1.026
Production ...	7,300,498	7,936,731	+ 8.7		
Stock	763,112	574,550	—24.7		
Michigan and northeastern Indiana:					
Shipments ...	5,480,428	5,747,113	+ 4.9	.944	1.168
Production ...	5,485,951	5,521,876	+ .7		
Stock	677,608	451,724	—33.3		
Southern Indiana and Kentucky:					
Shipments ...	2,761,941	3,266,215	+18.2	.703	.831
Production ...	2,828,561	3,238,942	+14.5		
Stock	501,432	477,232	— 4.8		

Illinois and northwestern Indiana:					
Shipments ...	10,879,655	10,637,659	— 2.2	.907	1.056
Production ...	10,242,869	10,360,563	+ 1.1		
Stock	1,479,474	1,193,341	—19.3		
Maryland, Virginia and West Virginia:					
Shipments ...	3,166,721	3,315,323	+ 4.7	.816	.904
Production ...	3,193,805	3,189,585	— .1		
Stock	359,913	235,511	—34.6		
Tennessee, Alabama and Georgia:					
Shipments ...	3,099,770	3,541,572	+14.3	.756	.980
Production ...	3,010,037	3,502,259	+16.4		
Stock	279,445	237,395	—15.0		
Iowa, Minnesota*, and Missouri:					
Shipments ...	9,218,820	11,178,790	+21.3	.882	1.089
Production ...	9,186,401	10,592,234	+15.3		
Stock	1,440,304	852,549	—40.8		
Nebraska†, Kansas, Oklahoma and central Texas:					
Shipments ...	6,517,258	7,735,418	+18.7	.872	1.168
Production ...	6,274,863	7,502,111	+19.6		
Stock	632,245	380,695	—39.8		
Rocky Mountain States (Colorado, Utah, Montana and western Texas):					
Shipments ...	2,453,095	3,141,855	+28.1	1.289	1.527
Production ...	2,472,069	3,097,385	+25.3		
Stock	242,024	198,984	—17.8		
Pacific Coast States (California, Oregon* and Washington):					
Shipments ...	5,910,559	6,901,095	+16.8	1.375	1.429
Production ...	5,999,522	6,830,454	+13.8		
Stock	956,594	814,140	—14.9		
Total:					
Shipments ...	86,891,681	94,552,296	+ 8.8	.860	1.058
Production ...	85,914,907	91,521,198	+ 6.5		
Stock	11,462,523	8,360,478	—27.1		

* No output in 1915.

† No output in 1916.

There Must Be More Business Than Usual

Howard E. Coffin, of the Advisory Commission of the Council of National Defense, says: "No radically new condition confronts us. State activities, road building, public works, private industries, all must go on as before. Business must be increased, labor employed and the country kept going strongly ahead as a successfully economic machine. We must have successful industries if successful tax levies are to be raised."

There should be no curtailment in building and road construction. Let both public and private useful construction proceed. Production and handling of building materials and public and private construction work are fundamental industries of the country. Any tendency to suspend or postpone building projects is inconsistent with maintaining our prosperity. The country is prosperous. Building investors should not hesitate to go ahead with their plans. Railroads should spare no effort to supply the building industry with the cars needed to transport materials. Government, state, county and municipal authorities should encourage the continuance of all kinds of building. Road and street improvements in particular should go on unabated. Bad roads and streets are factors of first importance in the present high cost of foodstuffs. Never before was the improvement of highways so essential.

The lumber, brick, cement, lime, sand, gravel, stone and other building material industries are basic. Neither Government regulations nor railroad restrictions should be imposed unnecessarily to interfere with them. If any action is taken which results in the prostration of so fundamentally important industries, there is real danger of a surplus of unemployed labor, a surplus of railroad cars and a crippling of business that will seriously embarrass the Government in financing the war.

Keep on building!



Stretch of the Toronto-Hamilton Highway which called forth a strong endorsement of concrete roads from the Christian Science Monitor, of Boston, Mass.

Making a Success of Road Contracting

Summary of the Factors That Need Attention in Getting the Contract and in Executing the Work--Imagination a Necessary Quality

BY H. ELTINGE BREED

First Deputy Highway Commissioner, New York State

All contract work is hazardous. That the building of roads has perhaps more often than any other form of construction proved itself a losing venture for the contractor is due to many causes. Within the limits of this article we can suggest only a few general ones which apply with equal force to every piece of highway work and for which there are definite remedies. They will be discussed under two general heads, "Getting the Contract" and "Doing the Work."

First, it may be noted that many contractors who are successes in other classes of work fail when they attempt highway work. Why? Because they lack imagination. They fail to discriminate between the static piece of work, such as a skyscraper, a bridge or a dam, where they can keep the whole procedure constantly under their eye, and the prolonged stretch of work on the highway, where their personal supervision at any one time can cover only a small fraction of the work. The highway is 10 miles in length. The contractor at no point can see more than 90 yards. His imagination must carry him over the 17,510 yards, meeting every condition his workmen are meeting, dovetailing every detail to a nicety, inspiring his force with esprit de corps—an intangible asset worth many dollars on any job. If the contractor lacks this power of imagination, if he cannot project his personality through space into the minds and hands of every workman, then he had better stay out of highway work.

Getting the Contract

But supposing he can honestly tell himself that he has these personal qualities, then his immediate practical concern is to get the award of the contract. He must prepare his bid. In doing this the essential thing is to make a thorough examination of the project

in hand, personally, if his experience warrants it, or through the employment either of an experienced contractor or of an engineer who has had contractual experience. The contractor who tries to avoid the expense of such services often disregards important factors or cheerfully accepts them as hazards which may come out all right, but which may cause his financial downfall.

These are important items to be considered in looking over work: (1) Plant, (2) local data, (3) climate, (4) financial arrangements, (5) cost data. They will be discussed in order.

1. Plant

Has the contractor a plant suitable for this particular job? Does he wish to buy such plant as a permanent investment? Will it pay to buy special equipment for this one piece of work?

While the difficulty and cost of getting labor constantly increase and its efficiency as constantly decreases, plant may often be made to pay for itself. Special equipment, even, may so reduce the price per mile as to lower the bid even after the first cost is included.

Further considerations about plant should include: (a) The relative economy of portable and semi-portable plants, (b) ease of manipulation of various units of plants, (c) transportation facilities for placing and moving plant.

To form an intelligent estimate of the price to be charged against the items for plant, one must figure the approximate cost of the plant, plus its depreciation and repairs, plus the cost of its operation and supplies, plus the cost of transportation to and from the work and the setting up, less the salvage value when the work is complete. One must estimate its average daily

capacity. With steam-shovel work, one must plan for enough equipment to keep the shovel continuously busy.

2. Local Data

Under this head, accurate computations can be made only by one thoroughly familiar with local conditions.

He must know the local labor market. Will his men work eight, nine or ten hours a day? At \$1.75 or \$2.00 or \$2.25? Compensation and insurance must be figured.

He must know the situation in respect to materials—transportation and length of haul.

He must know what provisions will have to be made for maintaining traffic.

He must decide whether pipe line will have to be installed to secure an adequate water supply.

He must determine the character and formation of the rock, and the depth of cutting.

He must understand the soil conditions and drainage, and be able to estimate the amount of wet excavation in ditches and foundations.

He must gage the necessary shifts of plant.

3. Climate

On climate and the number of working months depends the length of contract a man ought to take for one season. If the climate is bad, the work will be delayed. Under fair climatic conditions, such as obtain in most of New York state, a man could safely undertake from three to six miles with one plant and from six to twelve miles with two plants.

4. Financial Arrangements

Organization costs money. Overhead charges and superintendents' salaries must be counted in the cost of work. The contractor must have sufficient capital at his command to meet these charges, to pay for whatever new plant he needs, to cover transportation and freight charges, to meet his first payrolls, and to do the early part of the work, which is often the most expensive and unprofitable part. The interest on this capital, whether borrowed or not, should be added to the bill.

5. Cost Data

"Handle with care." Cost data represent averages. Conditions peculiar to a particular piece of work may vary those averages 100 per cent. On the wrong side, they may spell failure.

After these points have been carefully weighed, a few other suggestions may protect the contractor from an injudicious bid.

1. Bid a price sufficient to pay for new plant necessary, less its salvage value, and charge off depreciation of plants against your profits.
2. Protect yourself on the prices of all materials.
3. Figure everything accurately. Don't guess.
4. Remember that contingencies arise.
5. Bid higher if the market in labor and materials is rising; lower if falling.
6. Study your specifications.
7. Remember that the unit price depends on the size of the job.
8. Avoid "office bids," as the easy path to failure.
9. Estimate your profits.
10. Make your own bid; other contractors may make unbalanced bids or have special facilities for doing the work cheaply.
11. And don't try to beat the other fellow just because he once beat you.

Doing the Work

When the contractor has submitted his bid, and has been awarded the contract, he should begin work at once, taking up the key piece of the jigsaw puzzle, about which every other piece must be ready to fit instantly with absolute precision.

The key piece is his financial arrangements. Weakness here is the cause of many failures. If a man's credit is poor, he must pay a higher price for all material. If he is behind on his payrolls, he gets less work out of his men. If he has to assign his estimates, he becomes an object of suspicion to all who do business with him. For success and for his own happiness he must have adequate financial support. This must cover overhead expenses and payrolls until the work is in full swing; bond, insurance and compensation; installation of plant, and new plant to be acquired; materials and freight charges. He must remember that until a large percentage of the work has been done, and the payments for it begin to come in, he will have to keep on investing more capital every month. In requesting loans, therefore, a man should estimate liberally, and then keep within them. That inspires a bank with confidence, and means good credit.

How to Organize

A competent superintendent should be employed, one who has the ability to do everything without recourse to an overhead organization. He should be given authority and power to act in full whenever it is necessary. He must possess character, business ability and the qualities of leadership.



Concrete Road, Milwaukee County, Wis.

The most successful contractors organize their work on the basis of time, allowing a definite number of months for the completion of the work. By arranging a schedule, the contractor with imagination will plan exactly how and when each item can be done, what materials it will require, the time of their delivery, and the perfect adjustment of all the different classes of work, so that the job may move forward as an entity and not as a process of loose ends.

It is poor policy to try to do all the profitable items of work first, such as placing the pavement before the drainage has been perfected. Large losses may result from such procedures, especially if the weather turns bad.

Plant, Labor, Methods

Necessary plant should be procured at the lowest possible expense. It should give the lowest unit cost when figured on a basis of time. By decreasing labor costs and labor troubles it may turn the scale against a losing job. It should always be supported on adequate foundations, which are cheaper than the smash-ups and delays caused by the lack of them. Extra parts should always be on hand in case of accident. Money will be saved by careful planning for the smallest number of set-ups.

There is no better asset on a job than a force of well-cared-for, contented workmen. The contractor

will get much better results if he engages the men himself, instead of obtaining them through the contract system. To do this may require a larger outlay in money and energy, at first, but it will give returns beyond measure. They will further increase if the men are provided with good quarters and an economical commissary. The men, as well as the machines, need care and fuel if they are to be 100 per cent efficient. They need something more—good discipline, and a good working spirit diffused among them by the superintendent and contractor. The grumblers should be ousted and the good workers advanced as far as possible.

The successful contractor is always on the alert to improve his methods. Because a job is going well, it does not mean that it might not go better. Profits may always be increased by attention to details of procedure. When the daily cost of one method of work has been ascertained it is often wise to test another method and compare results. The work should always be planned so that once started, the men can work uninterruptedly at one thing for a full day.

Points That Contribute to Success

Here are some points that contribute to a contractor's success in highway work:

1. Always make excavations for cuts uphill; this drains your work.
2. Upon good drainage depends your ability to keep your men working.
3. All your contracts for materials should be executed for the life of the work.
4. Keep all your work going together, and keep your full-time men busy on rainy days; you can find something for them to do.
5. Keep your roller going all the time. You pay your roller man; make him work.
6. Have your materials ready in advance; then you will not be delayed when you are ready to use them.
7. For concrete work, buy the type of mixer that will do for both base and pavement work.
8. Keep each man at his own job in his own place. To let the men get in one another's way wastes time and money.
9. Keep your cars unloaded; don't pay demurrage.
10. Provide enough labor and teams to keep your plant working at full capacity.
11. Good storage facilities save your materials and your money.
12. Remember that it costs from \$200 to \$500 a mile to winter finished work.
13. Remember that every day over your time limit increases overhead charges and decreases your profits.
14. Successful work proceeds throughout the day in well-ordered continuity.

To Sum Up

Briefly, the success of large and small contractors in road work depends upon their ability to conduct a flexible, shifting organization; to plan and execute a mass of details, each trivial in itself, but contributing importantly to the whole; to "plant" work economically; to realize that intensive methods will not apply to extensive work; to obtain a good working force and especially a good superintendent; to finance the work adequately, and find profit in dollars rather than plant.

The suggestions above are generalities. Upon the human factor depends their successful application. Not every man can be a contractor; not every contractor can be a success in highway work. But the man who can, the man who possesses the personal qualifications and the understanding of working principles, will be a valuable factor in the nationally beneficial work of extending the mileage of good roads.

Good Form Design Saves in Labor and Lumber on Building Work

Form designs should be arranged to reduce the number of special panels and pieces, should take into account the total quantity required, considering the movement of the forms throughout the job, and should furnish an accurate key to the quantity and size of stock required and to the order in which the component parts should be made, according to a paper presented at the twelfth annual convention of the American Concrete Institute at Chicago by R. A. Sherwin of the engineering force of the Aberthaw Construction Company.

Such a design requires a careful study of the building plans, with a view to having modified such details as would make the form work unnecessarily expensive, and the immediate preparation of a progress chart. The latter is usually determined by the time allowed for completing the building. As soon as it has been prepared, the quantity of forms and the order in which they are to be erected and moved can be determined. This chart also shows when the form design must be ready to allow sufficient time for making up and erection.

A conference is then held between the men in charge of form design and the field men at which the sizes and kind of lumber that will be cheapest and that can be delivered on time are determined. The point at which work must begin and the location, type and capacity of the concrete plant must also be settled. The general scheme of the form work should be outlined at this conference with the field men to make sure that the design is understood and acceptable to them. If this is the case, they can carry it out much more readily.

The first study and drawings are made from a general assembly, which is selected from different combinations as the most economical for the conditions. Joists and girths should be in as few lengths as possible. Stock sizes of lumber should be used. The number of different panels and pieces should be kept to a minimum. Panels should be a whole number of boards in width, and joists should be used as panel cleats where possible. Units should be as large as can be handled, and detailed so they can be reused. Bracing should be above the men's heads, and provision should be made for easy stripping and for reshoring if necessary.

After the general assembly is made, sheets are detailed for each panel, ten panel details going on a standard-sized sheet. Each detail is marked according to a standard system of symbols. Blueprints from these sheets can be cut apart and used by the carpenters in making up the panels. A key plan showing the complete assembly, with the location of all the panels, is also prepared. This is made very complete, as it is the only plan referred to in assembling the forms. It has been found best to use large lettering and furnish photo-reduced copies to the job, as they are much easier for the foremen to handle and refer to. As a rule, one such plan is made for each floor.

An important point to be remembered in proportioning the form members is that the posts cannot be stressed above the crushing strengths of the girts which rest on them. The girts are stressed across the grain, which gives them a much lower allowable load for each post, spaces them closer together and reduces the danger of deflection and settlement while the floor is being poured.

Cement Mill Castings That Are Guaranteed

The Stroh Steel-Hardening Process Company of Pittsburgh has just issued a new catalog which they will gladly send to any of our readers. Gears, pinions, mine car wheels, heads and plates for gyratory crushers and other steel castings manufactured by the Stroh Process wear longer, reduce the repair account and increase the tonnage.

The Stroh Process is a method for casting finest alloy steel together with ordinary soft steel in one solid piece. The resultant casting has a wear-proof alloy steel stratum upon the wearing surface, while the body is composed of any desired steel and is in no way affected.

Stroh Process castings are peculiarly suited to service in Portland cement factories, and are now used extensively in the manufacture of 80 or more per cent of American cement. The fine suspended abrasive dust always present, and which often renders lubrication valueless, seems to have little or no effect on the hard Stroh alloy.

Smoothness in operation is gained, as their special pattern design and the glossy smooth surface attained give contour and service similar to those obtained from a cut gear when new.

There are no "knots," or hard nodules, there is no flowing, no spalling of metal. And Stroh Process castings are "wear proof"; they do not get old.

The Stroh Company are the largest manufacturers of tube mill pinions and gears and have achieved that success only through the service of their product. Their first installed (February, 1911), although continuously in service, are still in use, their pinions have worn many times as long as ordinary steel, and have not been turned. Sprockets, ball mill and jaw plates, etc., etc., render similar service.

A definite cash refunding guarantee is given with a trial order of Stroh Process castings. Immediate cash backs that guarantee.

Directory of Cement Mills

The 1917 edition of The American Cement Directory is now ready for distribution. It contains a complete list of cement companies in the United States and Canada, list of mills arranged by states, alphabetical list of officers, superintendents and chemists of cement companies, lists of brands of cement, statistics showing output of cement, officers of the Portland Cement Association, and a buyer's guide. The price of the book is \$1.00, postpaid. Inquiries should be addressed to The Bradley Pulverizer Co., Allentown, Pa.

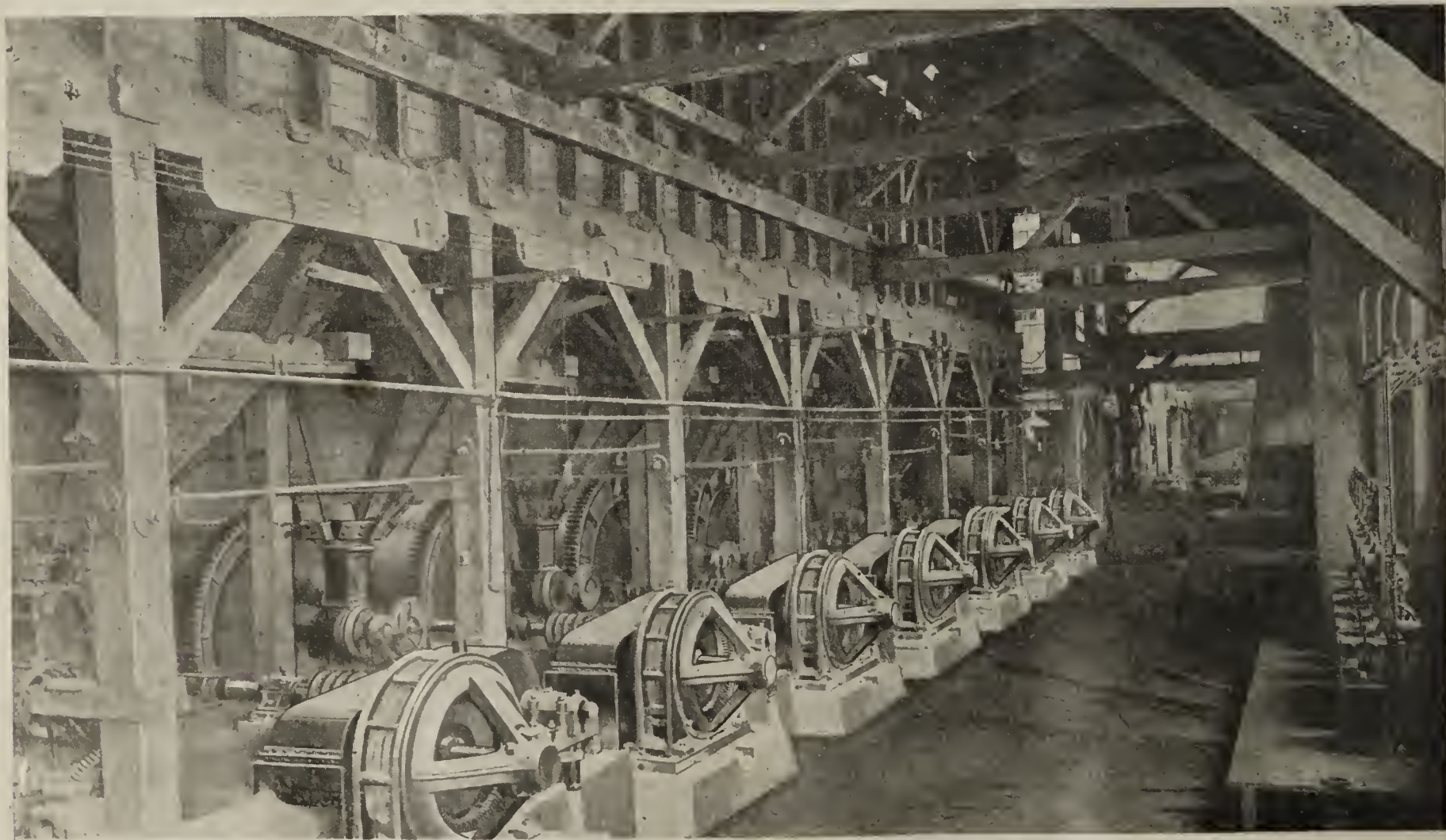
Silent Chain Drive for Cement Mills

In "Booklet 253" just issued by the Link-Belt Company, Chicago, the operation of silent chain drives in the plant of the Nazareth Cement Company, Nazareth, Pa., and other cement mills is described.

Thirty-two Link Belt Silent Chain drives were installed for this mill, totaling 3,500 horsepower, ranging from 35 to 150 horsepower each. These drives were installed and started in operation the early part of 1915 and are being operated constantly. The success of these drives has led to the adoption of other silent chains in the cement mills throughout the country.

After ten months' service, twenty-four hours a day, an inspection of the belts demonstrated they were practically as good as when they were installed—there being no evidence of undue wear upon the chains or wheels.

Advantages claimed for the silent drive include flexibility, positive as a gear and greater efficiency than either. Power is transmitted without slip or loss on short or long centers, in hot, cold, damp or oily places. Even the dust of cement mill service cannot reach the drive because of the patented, oil-tight, dust-proof casings.



Link Belt Company's Silent Chain Drives in the Plant of the Nazareth Portland Cement Company. Fuller-Lehigh Pulverizer Mills on Coal and Raw; Kominuters and Tube Mills on Raw and Clinker

Crushing Stone for the Market

Crushing stone for the market has become a business of enormous proportions in every part of the country where suitable material with adequate transportation facilities can be found, and the demand for the product is increasing constantly. In the presence of this growing demand a ledge of stone becomes as productive as a gold mine, and a gravel bank better than a commercial bank of deposit and circulation.

Among the most successful stone and gravel companies of the South is a Memphis concern, known as the Greenville Stone and Gravel Company. This company was organized in April, 1909. F. W. Katterjohn is president of the company; C. C. Hawkins, vice-president; L. O. McCourt, treasurer, and W. F. Paxton, secretary. The company operates plants in two states, while its general offices are in a third, at Memphis, Tenn., making it a tri-state concern. A quarry at Williford, Ark., comprising thirty acres, is in charge of H. McCourt. In addition to this five acres of gravel are owned at Greenville, Miss., from which the company takes its name. The Greenville operation is in charge of C. C. Hawkins.

The quarry operation at Williford is most interesting and deserves more than passing mention. Reaching out from Williford on its way to Springfield, Mo., the railroad skirts a ledge of very hard limestone, most excellent for railroad ballast and construction purposes generally. At the foot of the ledge, between it and the railroad, and partly climbing the hill, the Greenville Stone and Gravel Company has built a modern crushing and screening plant with a capacity of 2,000 tons per day. This plant is equipped with five crushers and the necessary screens for turning out crushed stone of any size desired, from dust up to three-inch cubes.

Quarry work started at the summit of the ledge, sixty feet above the railroad tracks, on a level with the top of the crushing plant. The top layer of this valuable hill of stone is now being taken off and hauled a few hundred feet back to the crusher. The entire process is by gravity from the time the contents of the steam shovel's dipper drop into the dump car until the load roars down a chute fifteen feet to the first crusher, except for a short haul of the loaded trains. This is accomplished with the aid of mules. It will take the company two years longer to work off the top of the ledge. When this has been done, the work will be moved down to another level, thirty feet above the railroad, and there continue as before.

The digging is accomplished by the aid of dynamite and an 80-ton steam shovel, with $2\frac{1}{2}$ -yard dipper. Fourteen specially constructed all-steel $1\frac{1}{2}$ -yard Western dump cars complete this part of the equipment. These cars are operated in trains of two, each train drawn by a single mule. The track is laid with a 2-foot gauge.



Top, Stone Trains Approaching the Crusher at Williford, Ark., Crushed Stone Plant

Center, Williford, Ark., Plant of Greenville Stone & Gravel Co.

Bottom, Dumping Stone Into the Crusher at Plant of Greenville Stone & Gravel Co.



The operation has been very successful, although it is probable that with the increasing length of the haul a wider gauge and larger cars will be found more efficient. The photographic reproductions given herewith, show operations at this quarry in an interesting way.

It takes but a moment to load the cars and another to dump them. The haul is short and easy—a single mule finding no difficulty in pulling two loaded cars. The driver with the help of one man dumps his train, one car at a time. The product of this quarry is in great demand both because of its quality and the efficiency of the management.

Portable Crushing Outfit

For many years, in buying a crushing plant, great capacity, and heavy weight were looked on as the most important points to consider. Times have changed, however. A crushing plant, portable or semi-portable, which weighs from 15,000 to 20,000 pounds, may be a very expensive proposition. Moving the machine to the rock was the original intention, but it may have to be moved often. For the last eight years, the Universal Crusher Company, 230 Bee avenue, Cedar Rapids, Iowa, has introduced light, portable and semi-portable crushing plants with which a small job may be completed before one of the heavier standard outfits would be even ready to move. For the same amount of labor, it is claimed that practically twice the work can be done with the smaller crushing outfits, and with greater ease and more satisfactorily.

By adjusting the crusher to the size desired, it is not necessary to have a rotary screen or very much of a loading bin, as the rock can be shot directly into the wagon if you desire to do so. Or, only a very inexpensive loading device is necessary. The product of these machines is very uniform on account of their particular motion. The adjustment is done almost instantly without stopping the machine—no changing of parts, and no need of tools to make this adjustment. You simply turn the hand wheel at the back of the crusher, to the right, to get fine material; and to the left, to make it larger. Accidents and delays are practically unknown to people operating "Universal" Crushers. A good many counties, townships, concrete contractors, and road builders have bought from one to four of these light outfits, and are pleased to certify as to their economical features. They have made a profit which was impossible with the heavier and more expensive standard outfits. Further, the Universal Crusher Company has sold over 3,000 machines during the last six years, which speaks for itself of their satisfactory working.

Twenty-five sizes are now offered to the trade, from which you can select just the size you need. All crushers are offered under a strict guarantee, and the machine must do the work as represented. It must be made of the very best material as specified, or money refunded. The prices are in reach of all; and one of the important features is that you can buy a small crusher, use it for one or two years, and then, if you wish a larger machine, you can return the smaller crusher, order the larger size and the company will allow you the full price paid, less 12½ or 15 per cent. All these points should be taken into consideration when a decision is being made regarding the buying of a crushing outfit. Send to the Universal Crusher Company, 230 Bee avenue, Cedar Rapids, Iowa, and let them mail you their catalogue.

Lightning Letter Opener

Anyone who has ever had to open a thousand letters by hand or by hand-operated letter openers knows the enormity of the task involved and the amount of time necessary to complete the operation. In addition, the greatest care has to be exercised in the opening process in order that any enclosures be not mutilated. All this can be eliminated, and the time required reduced to a minimum, by the use of the motor-operated opener shown. This device, called the "Lightning Letter Opener," opens the letters in a continuous stream, cutting only a thread from the edge of the envelopes, and in a seemingly uncanny way missing the enclosures. One of these letter openers in actual operation has opened 73,000 letters in a working day of eight hours.



Lightning Letter Opener

In operation, the unopened letters are placed on a feed table back of a guard, which has a capacity of 50 letters at a time. They are fed through one at a time by means of two rubber rollers which pass them along past two cutting wheels. The guard eliminates all possibility of the operator's fingers coming into contact with the cutters. The depth of the cut may be varied and set at will. After the letters are opened they are automatically thrown out and stacked up in the case of the machine, as shown in the illustration.

The "Lightning Letter Opener" is manufactured by the Lightning Letter Opener Company of Rochester, N. Y. It is operated by means of a 1-20 h. p. Westinghouse electric motor connected to the driving mechanism by means of a silent endless belt. By means of a cord and plug it may be connected readily to the nearest electric light socket, ready for instant use.

Traylor Crushing Rolls

Heavy duty crushing rolls, jaw crushers, and gyratory crushers for meeting every crushing need, as manufactured by the Traylor Engineering & Manufacturing Company, Allentown, Pa., are illustrated and described in Bulletin R-1 issued by the company. Full and complete description with illustrations is given regarding the construction of these crushers and their special features are pointed out in this bulletin. Main frame, bearings, tension springs and rods, end adjustment, shafts, hearts, tires or shells, holding-down device, driving pulleys, housings, feed hopper, cheek plates, automatic lateral adjustment for fleeting roll (a special Traylor device), etc., are illustrated and described separately, giving the reader a comprehensive understanding of the operation and construction of the vital parts of Traylor crushers.

Suggested Specifications for Concrete Floors

As Prepared and Published By Portland Cement Association

(Continued from June issue)

Concrete Slab

18. **Proportions:** The concrete shall be mixed in the proportions by volume of one (1) sack of Portland cement, two (2) cubic feet of fine aggregate and four (4) cubic feet of coarse aggregate.

19. **Consistency:** The materials shall be mixed wet enough to produce a concrete of a consistency that will flow into the forms and about the reinforcement, but which can be conveyed from the mixer to the forms without the separation of the coarse aggregate from the mortar.

20. **Placing:** The concrete shall be placed in a manner to insure a smooth ceiling, and thoroughly worked around the reinforcement and into the recesses of the forms. Concrete shall be deposited in its full position as soon as possible after mixing and within thirty (30) minutes after the water has been added to the dry materials. It shall be struck off to a surface at least one (1) inch below the established grade of the finished surface of the floor. Workmen shall not be permitted to walk in freshly laid concrete, and if sand or dust collects on the base it shall be carefully removed before the wearing course is applied.

21. **Joints:** When it is necessary to make a joint in a floor slab, its location shall be designed by the architect or engineer; joints to be vertical.

Wearing Course

22. **Proportions and Thickness (Mixture No. 1):** The mortar shall be mixed in the proportions of one (1) sack of Portland cement and two (2) cubic feet of fine aggregate. The minimum thickness shall be three-quarters ($\frac{3}{4}$) inch.

23. **Proportions and Thickness (Mixture No. 2):** The mortar shall be mixed in the proportions of one (1) sack of Portland cement, one (1) cubic foot of fine aggregate and one (1) cubic foot of No. 1 aggregate for wearing course. The minimum thickness shall be one (1) inch.

24. **Consistency:** The mortar shall be of the dryest consistency possible to work with a sawing motion of the strikeboard.

25. **Placing:** The wearing course shall be placed immediately after mixing. It shall be deposited on the fresh concrete of the base before the latter has appreciably hardened, and brought to the established grade with a strikeboard.

Note: When placing the wearing course after the concrete slab has hardened, eliminate paragraph 25 and substitute the following:

26. **Preparation of Slab:** The surface of the slab shall be thoroughly roughened by picking, and swept clean of all dirt and debris.

27. **Placing:** The slab shall be thoroughly moist but free from pools of water when the grout and mortar for wearing course is placed. A neat cement grout shall be brushed on the surface of the slab, the wearing course immediately applied and brought to the established grade with a strikeboard. Grout and mortar shall be used within forty-five (45) minutes after mixing with water.

28. **Finishing:** After the wearing course has been brought to the established grade by means of a strikeboard, it shall be worked with a wood float in a manner which will thoroughly compact it and provide a surface free from depressions or irregularities of any kind. When required the surface shall be steel-troweled, but

excessive working shall be avoided. In no case shall dry cement or a mixture of dry cement and sand be sprinkled on the surface to absorb moisture or to hasten the hardening, but the Bruner method may be used if desired.

29. **Coloring:** If artificial coloring is used it must be incorporated with the entire wearing course and shall be mixed dry with the cement and aggregate until the mixture is of uniform color. In no case shall the amount of coloring exceed five (5) per cent of the weight of the cement.

Plain Concrete Flooring

For plain concrete floors the following will apply in addition to the general requirements:

Subgrade

30. **Preparation:** All soft and spongy places shall be removed and all depressions filled with suitable material which shall be thoroughly compacted in layers not exceeding six (6) inches in thickness. The subgrade shall be thoroughly tamped until it is brought to a firm, unyielding surface.

31. **Deep Fills:** All fills shall be made in a manner satisfactory to the architect or engineer. The use of muck, quick-sand, soft clay, spongy or perishable materials is prohibited.

32. **Drainage:** When required, a suitable drainage system shall be installed and connected with sewers or other drains indicated by the engineer.

33. **Depth:** The subgrade shall not be less than (00) inches below the finished surface of the floor.

Note: Subgrade to be five (5) inches below the finished surface of the floor when subbase is not required, and at least eleven (11) inches below when subbase is required.

Subbase

(Omit these sections when subbase is not required.)

34. **Thickness:** On the subbase shall be spread a material as hereinbefore specified, which shall be thoroughly rolled or tamped to a surface at least (00) inches below the finished grade of the floor. On fills the subbase shall extend the full width of the fill.

35. **Wetting:** While compacting the subbase, the material shall be kept thoroughly wet, and shall be in that condition when the concrete is deposited.

Forms

36. **Materials:** Forms shall be free from warp and of sufficient strength to resist springing out of shape.

37. **Setting:** The forms shall be well staked or otherwise held to the established lines and grades and their upper edges shall conform to the established grade of the floor.

38. **Treatment:** All wood forms shall be thoroughly wetted and metal forms oiled or coated with soft soap or whitewash before depositing any material against them. All mortar and dirt shall be removed from forms that have been previously used.

Construction

39. **Size of Slab:** The slab or independently-divided blocks when not reinforced shall have an area of not more than one hundred (100) square feet, and shall not have dimensions greater than ten (10) feet. Larger slabs shall be reinforced as hereinafter specified.

40. **Thickness of Floor:** The thickness of the floor shall be not less than five (5) inches.

41. **Width and Location of Joints:** When required by the architect or engineer in charge, a one-half ($\frac{1}{2}$)

inch space or joint shall be left between the floor and the walls and columns of the building, to be filled with the material before specified under "Joint Filler."

42. Protection of Edges: Where required by the architect or engineer in charge, the edges of the slabs at the joints shall be protected by metal. Unless protected by metal, the upper edges of the slabs shall be rounded to a radius of one-half ($\frac{1}{2}$) inch.

Concrete Base

(Two-Course Floor)

43. Proportions: The concrete shall be mixed in the proportions by volume of one (1) sack of Portland cement, two and one-half ($2\frac{1}{2}$) cubic feet of fine aggregate and five (5) cubic feet of coarse aggregate.

44. Consistency: The materials shall be mixed wet enough to produce a concrete of a consistency that will flush readily under slight tamping, but which can be handled without causing a separation of the coarse aggregate from the mortar.

45. Placing: After mixing, the concrete shall be handled rapidly and the successive batches deposited in a continuous operation completing individual sections to the required depth and width. Under no circumstances shall concrete that has partly hardened be used. The forms shall be filled and the concrete struck off and tamped to a surface the thickness of the wearing course below the established elevation of the floor. The method of placing the various sections shall be such as to produce a straight, clean-cut joint between them so as to make each section an independent unit. If dirt, sand or dust collects on the base it shall be removed before the wearing course is applied. Workmen shall not be permitted to walk on the freshly-laid concrete. Any concrete in excess of that needed to complete a section at the stopping of work shall not be used. In no case shall concrete be deposited upon a frozen subgrade or subbase.

46. Reinforcing: Slabs having an area of more than one hundred (100) square feet, or having dimensions greater than ten (10) feet, shall be reinforced with wire fabric, or with plain or deformed bars. The reinforcement shall have a weight of not less than twenty-eight (28) pounds per one hundred (100) square feet. The reinforcement shall be placed upon and slightly pressed into the concrete base immediately after the base is placed. It shall not cross joints and shall be lapped sufficiently to develop the full strength of the metal.

Wearing Course

47. Proportions for Mixture No. 1: The wearing course shall be mixed in the proportions of one (1) sack of Portland cement, two (2) cubic feet of fine aggregate. The minimum thickness shall be three-quarters ($\frac{3}{4}$) inch.

48. Proportions for Mixture No. 2: The wearing course shall be mixed in the proportions of one (1) sack of Portland cement and one (1) cubic foot of fine aggregate, and one (1) cubic foot on No. 1 aggregate for wearing course. The minimum thickness shall be one (1) inch.

49. Consistency: The mortar shall be of the dryest consistency possible to work with a sawing motion of the strikeboard.

50. Placing: The wearing course shall be placed immediately after mixing. It shall be deposited on the fresh concrete of the base before the latter has appreciably hardened, and brought to the established grade with a strikeboard. In no case shall more than forty-five (45) minutes elapse between the time the concrete for the base is mixed and the wearing course is placed.

51. Finishing: After the wearing course has been brought to the established grade by means of a strikeboard, it shall be worked with a wood float in a manner which will thoroughly compact it and provide a

surface free from depressions or irregularities of any kind. When required, the surface shall be steel-troweled, but excessive working shall be avoided. In no case shall dry cement or a mixture of dry cement and sand be sprinkled on the surface to absorb moisture or to hasten the hardening, but the Bruner method may be used if desired. Unless protected by metal the surface edges of all slabs shall be rounded to a radius of one-half ($\frac{1}{2}$) inch.

52. Coloring: If artificial coloring is used it must be incorporated with the entire wearing course, and shall be mixed dry with the cement and aggregate until the mixture is of a uniform color. In no case shall the amount of coloring exceed five (5) per cent of the weight of the cement.

One-Course Floor

53. Proportions: The concrete shall be mixed in the proportions of one (1) sack of Portland cement to not more than two (2) cubic feet of fine aggregate and not more than three (3) cubic feet of coarse aggregate, and in no case shall the volume of fine aggregate be less than one-half ($\frac{1}{2}$) the volume of the coarse aggregate.

A cubic yard of concrete in place shall contain not less than six and eight-tenths (6.8) cubic feet of cement.

54. Consistency: The materials shall be mixed with sufficient water to produce a concrete which will hold its shape when struck off with a strikeboard. The consistency shall not be such as to cause a separation of the mortar from the coarse aggregate in handling.

55. Placing: After mixing, the concrete shall be handled rapidly and the successive batches deposited in a continuous operation completing individual sections to the required depth and width. Under no circumstances shall concrete that has partly hardened be used. The form shall be filled and the concrete brought to the established grade with a strikeboard. The method of placing the various sections shall be such as to produce a straight, clean-cut joint between them so as to make each section an independent unit. Any concrete in excess of that needed to complete a section at the stopping of work shall not be used. Workmen shall not be permitted to walk on the freshly-laid concrete. In no case shall concrete be deposited upon a frozen subgrade or subbase.

56. Reinforcing: Slabs having an area of more than one hundred (100) square feet, or having any dimensions greater than ten (10) feet, shall be reinforced with wire fabric or with plain or deformed bars. The reinforcement shall have a weight of not less than twenty-eight (28) pounds per one hundred (100) square feet. The reinforcement shall be placed upon and slightly pressed into the concrete base immediately after the base is placed. It shall not cross joints and shall be lapped sufficiently to develop the full strength of the metal.

57. Finishing: After the concrete has been brought to the established grade by means of a strikeboard, and has hardened somewhat, but is still workable, it shall be floated with a wood float in a manner which will thoroughly compact it and provide an even surface. When required, the surface shall be steel-troweled, but excessive working shall be avoided. Unless protected by metal the surface edges of all slabs shall be rounded one-half ($\frac{1}{2}$) inch.

Japanese Cement Mills

In response to telegraphic orders, Harold Henry, Ohio State University graduate, leaves for Japan as the representative of the Allis-Chalmers Company of Milwaukee to Americanize six large cement plants. He spent last year in Russia for the same company, doing similar work.

Edison Portland Cement Plant Remodeled

Advantage Taken of 1915 Lull in Business to Install Combination Ball-and-Tube Mills and Other Machinery of Modern Type

BY PERCY H. WILSON
Consulting Engineer, Philadelphia

During the year 1915 the Edison Portland Cement Company, owing to the ruinous price at which Portland cement was being sold, shut down its plant at New Village, N. J., and withdrew its brand from the market. The nucleus of its organization was retained, and plans were begun immediately for extensive changes in the mill in order to effect a saving in the cost of manufacture, and at the same time meet those changes in the character of Portland cement demanded by increased knowledge of the material. The plans have been carried out and a comparison of the results obtained by the old and the new methods is afforded.

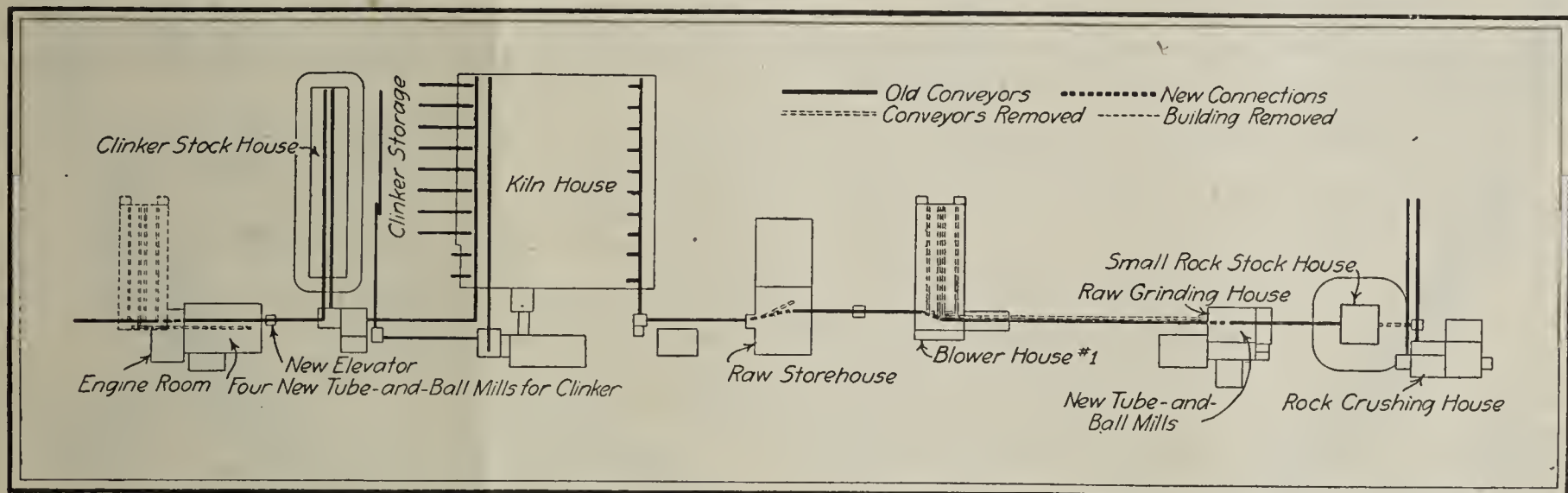
The original plant started operation in 1902, at a time when only 9,000,000 barrels of Portland cement was manufactured yearly in the United States, and the principles of the machines installed were such an advance in the art of manufacture as to cause much comment and stamp Thomas A. Edison as one who had thoroughly analyzed the future requirements of the cement-using public. Because of the attention which the original installation commanded, the changes just completed are of more than ordinary interest.

separation is used in many types of grinding machines accepted as standard, and is in use in many cement plants.

New Limits in Portland Cement.

Engineers and contractors, having become accustomed to the use of natural cement, were not so insistent 15 years ago on the uniformity of action of Portland cement as they are today, and the control of the various stages of manufacture necessary to obtain such uniformity of action was not so generally understood. A greater knowledge was obtained, however, specifications were changed, closer limits were placed on the manufactured product and account was taken not only of the physical properties of the cement but also of its uniformity of action in use. During the last few years it has become quite generally known that not only the amount of cement passing the 200-mesh screen has an effect on its cementing quality, but that cement which would pass a 300, 400 or 500-mesh screen, were such a screen commercially possible, plays even a more important part.

The fineness of the raw material when it enters the



GENERAL PLAN OF THAT PART OF EDISON PLANT AFFECTED BY THE RECENT CHANGES

Original Plant a Model.

A thorough description of the plant as originally built is contained in Cement & Engineering News of December, 1903. Since that time the plant has manufactured and shipped more than 15,000,000 barrels of cement. The main principles involved, which have been and are being used by practically every cement-manufacturing company in the United States, were the long kiln, the automatic weighing device for proportioning materials, and crushing of material by the use of rolls, the air separation or sizing of the ground particles and the use of individual electric motors for operating all plant units except the rolls.

Cement manufacturers in all parts of the United States, profiting by the experience of the Edison company, adopted such of these principles as best fitted their own particular materials, making changes and improvements in recognition of the development of the art at the time of the change, or in the building of new plants. The adoption of the long kiln and of the automatic weighing device was almost universal. Individual electric drive has been quite generally adopted. Rolls for preliminary crushing of the raw material have been installed in several plants. The principle of air

kiln also has an effect on the uniformity of the clinker and makes the control of the later processes of manufacture much more simple, insuring a greater uniformity of action of the finished product. It will readily be seen that the method of grinding employed has much to do with the real fineness of both the raw material and the finished product.

Edison Changes Recognize Advances.

The changes which the Edison company has made have fully recognized all these advances in our knowledge of Portland cement. In planning the changes the company has profited by the action of the various classes of grinding machinery in use in other cement mills, not only in the Lehigh Valley, but in all parts of the United States.

Briefly, for crushing both raw material and clinker down to $\frac{1}{2}$ -inch the company has retained its roll crushers. For the final grinding of both raw material and clinker it has installed combination ball-and-tube mills, accepting for the final reduction of its materials the principles of grinding accepted as standard wherever cement is manufactured. The present method of manufacture is in principle the same as that employed by the other Lehigh Valley mills.

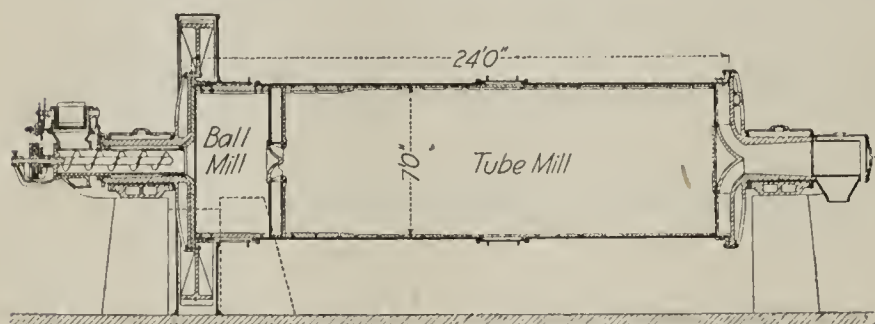
The objects to be obtained in the remodeling of the plant were the manufacture of a more uniform product, the installation of such machinery as would insure such uniformity with minimum variations, and a decreased amount of labor, and with such an installation as would result in a reduction in the cost of manufacture.

It is much more difficult to plan changes in an old plant than to plan a new plant. Dr. H. E. Kiefer, works manager, made 15 plans, each of which would accomplish the first two of the desired results. In this work consideration was given to the present power capacity, utilizing to as great an extent as possible the old arrangement of the plant, as well as the old machinery thrown out of commission by the new method of final grinding.

The plan ultimately adopted made necessary a redistribution of power, the moving of the tube mills, which are being used to increase the fineness of coal grinding, and the scrapping of the entire air-separation system, as well as seven sets of rolls previously used for final grinding of both raw material and clinker. A slight rearrangement of conveyor belts was made.

Combined Tube-and-Ball Mills.

The new installation consists of eight 7x24-foot combined tube-and-ball mills, made by the Allis-Chalmers Manufacturing Company. These are the largest tube



COMBINATION TUBE-AND-BALL MILLS A FEATURE OF THE REMODELED PLANT

mills in use in the United States. Four of them are for the grinding of the raw material and four for the grinding of the clinker. The installation is the same on both the raw material and clinker grinding sides. Two of the mills on each side are driven by a vertical cross-compound engine, also made by the Allis-Chalmers Company. These two engines were used to run the abandoned roll grinders. The other four mills, two on each side, are driven by individual 450-h. p. direct current motors, manufactured by the General Electric Company.

Each of the tube mills is divided into two compartments. The material entering the first compartment has been previously reduced to one-half inch or under. The grinding in this compartment is accomplished by from 15,000 to 20,000 pounds of steel balls, ranging in size from 2½ to 5 inches in diameter. The length of this compartment can be varied from 3½ to 6½ feet. The material is here ground to such fineness that 90 per cent will pass through a 20-mesh screen. Passing through a slotted plate, the material goes to the second compartment. Here grinding is effected by 70,000 pounds of "manganoid" balls, 7/8 inch in diameter.

The fineness of grinding depends on the length of time the material remains in each compartment, this in turn depending on the speed with which the material is fed into the grinding mill. The raw material is ground until 85 per cent will pass a 200-mesh screen, and each tube mill turns out about 25 tons per hour. The clinker is ground until 82 per cent will pass a 200-mesh screen, and each tube mill turns out about 75 barrels per hour.

The following table will give a digest of some of the results obtained, from a mechanical standpoint:

Results Obtained by the Changes.		
Power—	Old System	New System
Raw material mills	1,712 h. p.	1,862 h. p.
Clinker mills	1,648 h. p.	1,688 h. p.
Total.	3,360 h. p.	3,550 h. p.
Conveying and Elevating Machinery—		
Raw material mills	2,195 lin. ft.	594 lin. ft.
Clinker mills	1,942 lin. ft.	318 lin. ft.
Total	4,137 lin. ft.	318 lin. ft.
Number of Motors—		
Raw material mills	24	9
Clinker mills	36	9
Total	60	18

The two tube mills, 7 feet in diameter by 10 feet long, released by the change have been installed in the coal grinding house, and have increased the fineness of coal grinding to 80 per cent through a 200-mesh screen.

The air separation system has been eliminated.

The raw material is being ground so that 85 per cent will pass a 200-mesh screen, instead of 75 per cent, as in the old system. The clinker is being ground to the same degree of fineness as heretofore, but the present method of grinding will increase the very fine material, mentioned before, by about 10 per cent.

The time of set, based on the average of tests of 100,000 barrels, shows: Initial set, old process, 5 hours 45 minutes; new process, 3 hours 13 minutes; final set, old process, 9 hours 20 minutes; new process, 7 hours 6 minutes.

A comparison of strength tests made on material manufactured by the old and the new processes gives:

Increase in percentage		Increase in percentage	
24 hours, neat.....	2	7 days, 3 sand mortar....	18
7 days, neat.....	18	28 days, 1 sand mortar....	28
28 days, neat.....	11		

The cement passes the soundness test without seasoning.

The limits of the variation of the finished product have been greatly reduced.

The color of the new material is steel gray, when gaged neat with water. The color of the material manufactured by the old process was muddy yellow.

Waterproofed Cement

One of the easiest ways to avoid dampness in cellars and walls is by the use of a waterproofed cement, and valuable information concerning such a material is contained in a booklet entitled "Medusa Waterproofed Portland Cement," distributed by the Sandusky Cement Co. Directions for using are given, together with specifications for stucco on metal lath; stucco on brick, stone, hollow tile, etc.; plaster for foundations, walls, floors, etc.; mortar for laying up brick and stone, also reinforced or mass concrete. Illustrations and testimonials are a feature of the booklet. CEMENT AND ENGINEERING NEWS, 672 Transportation Bldg., Chicago, will gladly send you a copy of this booklet.

New Superintendent Glens Falls Cement Plant

W. A. Pollock has assumed his duties as general superintendent of the Glens Falls Portland Cement Co. He comes from the Atlas Portland Cement Co., with which he was connected for more than 12 years, and was within a recent period the superintendent of the Hudson river plant of that company.

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Everything Considered—

are by far the most economical belts you can buy today in the World's markets—and the most satisfying in service. We have the proofs.

"Longlife" is not only the best Conveyor Belt made today anywhere—none barred—but the best known.

You can have it in any width, ply or length. Every tough, gristly, muscular inch of it, backed by a powerful organization anxious to see it give you a better service than you have ever received from any other Conveyor Belt.

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Cost of Synstone Single Wall

Synstone, composed, as it is, of 1 part cement, 2½ parts sharp sand and small gravel, and 4 parts of crushed rock or gravel to 1 inch screen, will vary in cost of manufacture, as well as erection (because of different prices of labor and material) in various parts of the country. The following rules are given by the Ferguson Synstone Company, Denver, Colo., to enable a quick computation of manufacturing and erection costs when the prices for a given territory are used:

Two experienced men can easily manufacture fifty Synstone blocks per hour (100 square feet), but to cover average output and lack of efficiency in some plants, 40 blocks (80 square feet) are used as the basis for the following rule. This output is based on mixture being supplied.

Cost Per Square Foot of Synstone

Add the following items:	
	Average price outside large cities
4.4 x cost of sack of cement at 40c* sack.....	\$1.76
.4 x cost of a yard of sand at \$1* cu. yd.....	.40
.65 x cost of rock or gravel at \$1* cu. yd.....	.65
Cost of man and helper at 47c* per hour.....	.47

The cost per square foot to lay Synstone blocks is found by the following rule:

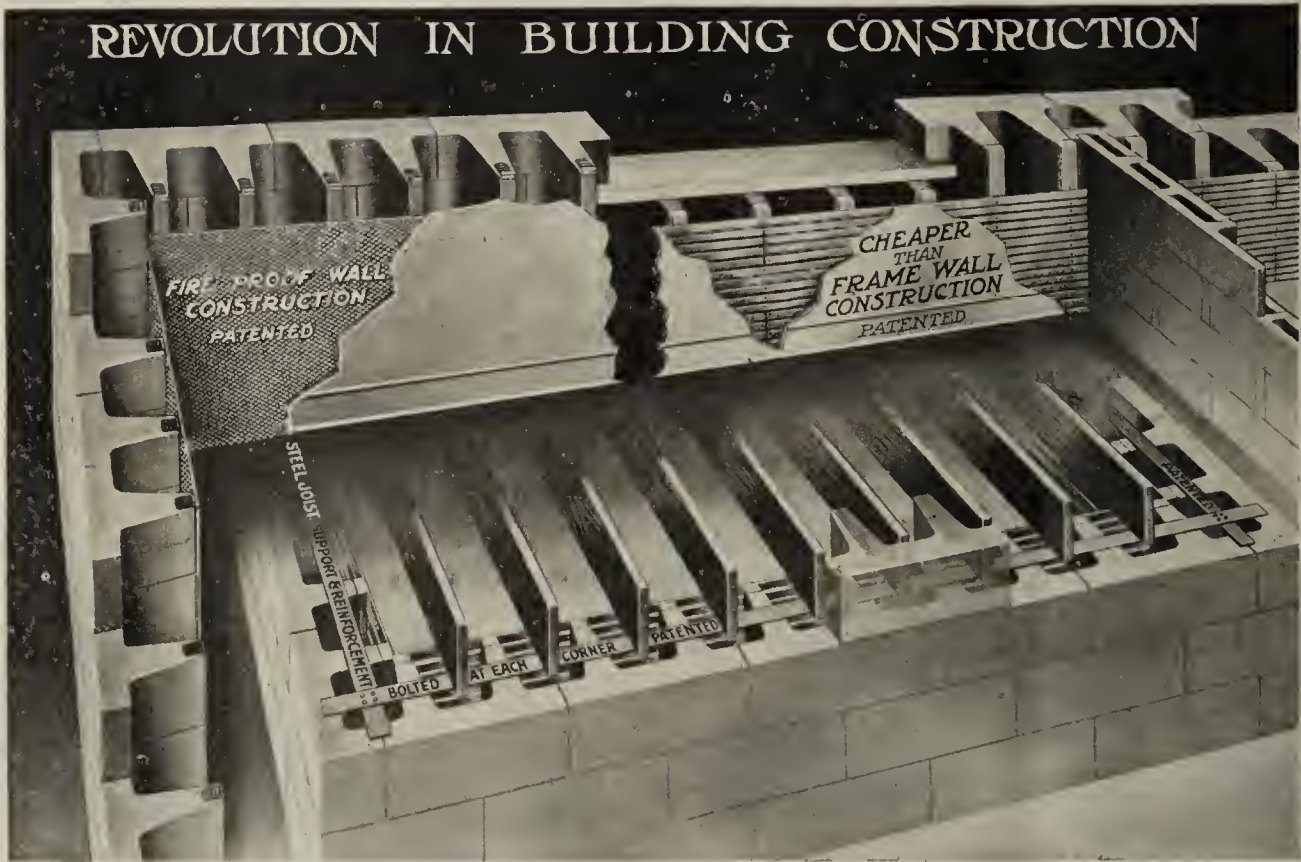
Add the following items:	
Total cost of labor per hour—Mason, 50c*; helper, 30c*, and laborer, 25c*.....	\$1.05
.158 x cost of 1 cubic foot cement at 40c*.....	.06
.63 cubic feet of sand at \$1.00* per yard.....	.025
1 lb. hydrated lime at \$12 per ton.....	.006
Cost of delivery 15 blocks at 2½c* each.....	.37
Furring at 2c* per square foot.....	.60
Total.....	\$2.116

*Substitute your local costs.

Which, divided by 30 (sq. ft.) equals 7 cents per square foot for the total erection cost of Synstone.

The total cost to make and lay Synstone, without profit, is 11 4-10 cents per square foot of wall; add 1¼ cents per square foot extra for facing; total, 12 6-10 cents.

The manufacturer of Synstone will, as a rule, erect the Synstone building; but if he sells the blocks to a contractor who in turn will erect them into the building, the manufacturer doubles his manufacturing cost, which gives him the selling price.



Synstone Single Wall, 9 to 13 Inches

Cost of man for mixing at 23c* per hour.....	.23
Total.....	\$3.51

*Substitute your local costs.

Divide this total by 80 (sq. ft.) and the result is 4 4-10 cents per square foot to manufacture Synstone.

Three men will lay 250 blocks per eight-hour day on straight wall with few openings or 100 blocks per eight-hour day where there are many corners and openings.

A fair average under general conditions is 120 blocks per day of eight hours, or 15 blocks (30 sq. ft.) per hour. There is a ¾-inch mortar joint.

Mortar consists of:

- 1 part cement.
- 3 parts sand.
- 7% hydrated lime (based on the weight of cement).

The contractor usually adds 20 per cent profit to his cost of labor, material and erection.	
The cost of Synstone to the home builder, in localities where prices range as given above, will be:	
	Per sq. ft.
Manufacturer's net cost of blocks.....	\$.44
He adds 100% profit.....	.044
Cost to the contractor.....	\$.088
Erection cost, including furring.....	.07
Contractor's 20% profit on total cost.....	.031
Total cost of unfaced Synstone to home builder	\$.189
Add for faced Synstone.....	.01¼
Total cost of faced Single Synstone wall to home builder (erected).....	\$.201

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Everything a batch mixer ought to have is contained in this machine.

Our Tilting Drum guarantees a perfect speedy mix—single opening, large capacity, easy to load and unload and always clean.

The Drum is entirely open to view at all times.

The Mixer has proven by test to be most economically operated.

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Our new folder shows the entire line.

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Packard LOW CHARGER

The "Easy to clean," Patented "High Speed" Mixing and Discharge Action is one of the few that successfully and fast handles

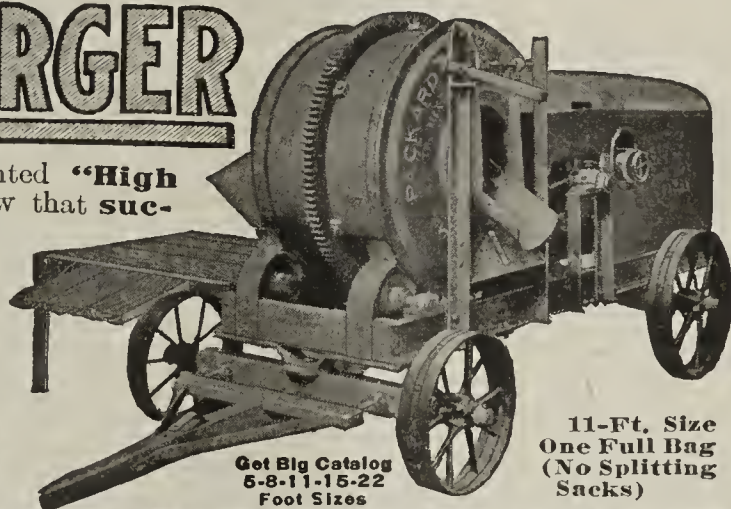
STIFF CONCRETE FOR CURBS, GUTTER AND SIDEWALK WORK

Get our astonishingly low prices on these sturdy, built-of-steel mixers—also our Terms. 6 and 11-ft. sizes—also with Loaders. Quick deliveries from stock carried in all large cities. Write nearest office

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THE 300,000 HP ELECTRIC CITY

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11-Ft. Size
One Full Bag
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PAVERS-GROUND-LEVEL-ROADS-PAVERS

DUNN CONCRETE MIXERS

A Handwheel On Each Side

Hand labor is expensive and hard to get. The Dunn Mixer does the work of several men, and does it better. Five big features assure a degree of mixing efficiency, rapidity and economy possessed by no other mixers of the popular tilting drum type. The Dunn machine has the discharge-from-either-side feature; the double-handwheel is exclusively a Dunn innovation.

In size and price the Dunn is just right, for average contracting. Easy to operate, economical to run. Built rugged enough to withstand the hardest usage. Write for Dunn Mixer Bulletin. Agents Wanted.

W. E. DUNN MFG. CO., 414 24th St., Holland, Mich.



SOLD ON 15 DAYS' TRIAL

How One Contractor Prepares His Mortar

There are various methods in vogue of getting mortar ready, but the one here described is practically a new one in most places. The method has worked out well for the Byers Construction Company of Kalamazoo, and Mr. Adams, general superintendent of the work, should be given credit for having originated this unique idea.

A pit is first prepared that will take care of a car-load of lime. In the one shown in the illustration, which is on the Byers' work at East Lansing, the pit is 30 feet long, 18 feet wide and 4 feet deep. Into this pit was dumped 235 barrels of lime and sufficient water added to slack it. About four inches of sand is then put on top of the mortar and every night this is wet down thoroughly to keep the lime at the proper temperature. The mortar is kept cool in this way and goes further than when it is slacked just before using. A Lansing mortar mixer is used for mixing the mortar, and this is set as conveniently close to the pit as possible. On

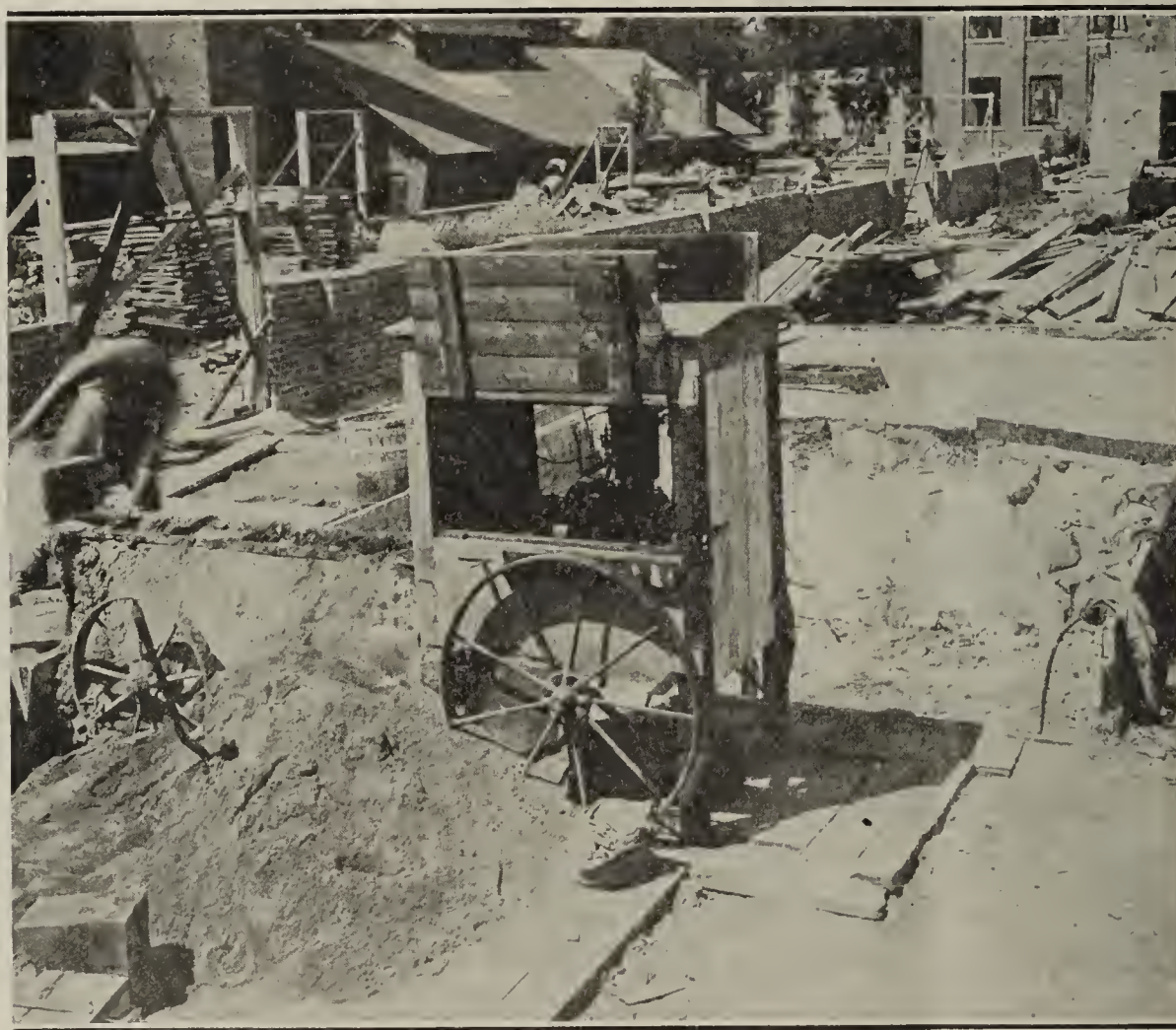
ness. The owners claim that it has paid for itself dozens of times during the period they have had it.

Mr. Adams, of the Byers Company, is an enthusiastic supporter of machine-mixed mortar, and says that he could no more think of mixing his mortar the old way than he could go back to turning concrete by hand. Modern methods properly applied have contributed largely to the success of this company. Cement & Engineering News, Transportation Building, Chicago, will gladly mail any of its readers a catalogue concerning the Lansing mortar-mixer.

Sprocket and Traction Wheels

The Lehigh Car, Wheel & Axle Works, Catasauqua, Pa., has just issued a new catalogue and price list of its Fuller Quality face hardened sprocket and traction wheels, used extensively in cement mills. The catalogue is a 64-page book printed on a fine grade of glazed white paper, with a heavy tan cover, and well illustrated with photographs and drawings.

The company is a pioneer in the manufacture of chilled charcoal iron castings especially adapted for service subjected to severe abrasion, such as is com-



Machine for Mixing Mortar

the other side of the mixer is the sand pile. One man with the mixer will mix enough mortar to supply any number of masons up to 30. He also screens the sand and adds the cement to it before it is shoveled into the machine. He first puts in so many shovelfuls of the mortar and then adds the sand, to which the cement has already been added. In a very few minutes the batch is mixed to the finest possible consistency, and it is then discharged into the large box under the end of the mixer trough.

He then proceeds with another batch. The cost of operating the mixer is very low, as about the only expense is the gasoline and oil that the engine consumes. The mixer shown in the picture has seen eight years of service, but it is still clicking along and nobody seems to believe that it has yet reached the end of its useful-

mon in cement mills. The catalogue includes descriptions, data and prices on sprocket wheels, traction wheels, spur, bevel and mitre gears, ring gears, tube mill linings, mill rolls, and many other castings and machines used by the cement manufacturer.

The tube mill linings are made of chilled charcoal iron plates, the inner or wearing surface hard and resisting abrasion, the outer, of soft strong iron. Cup-shaped depressions in the plate aid in elevating the load on the rising side of the cylinder and increasing the grinding surface. No bolts or other mechanical aid is needed in holding the plates in place. They are of one-man size and are introduced in the mill by propping them temporarily until the last plate of the circle is put in. This plate acts as a key and the circle needs no support.

"Business Better Than Ever Before"

(A Statement by the Polk Genung Polk Company)

THE move toward conservation of the nation's resources has greatly stimulated the building of grain storage, coal pockets, and silos. Instead of the war giving us a setback, it has put us to working overtime. Not only are prospects better, but "BUSINESS IS BETTER THAN EVER BEFORE." Without reservation we say that never before has there been as good a chance for the concrete man to make money by building monolithic concrete silos, coal pockets, water tanks, and grain storage.

Silos

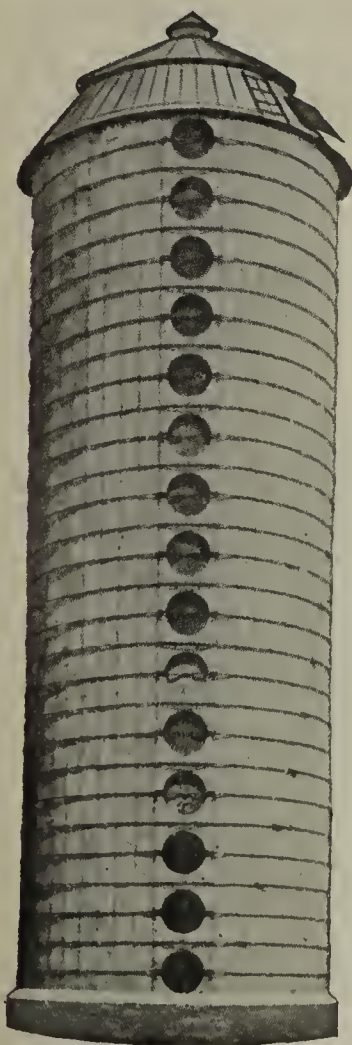
Water Tanks

Coal Pockets

Grain Storage

Polk Genung Polk Company
Fort Branch, Indiana

The POLK SYSTEM 175 W. Jackson Blvd.
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YOU will recognize this Cement Stave Silo is built with Pierce Round Steel Doors. These doors are rapidly eliminating wood doors, also spreaders which frame the opening in an ungainly, awkward manner.

ABSOLUTELY FIRE-PROOF.

Simple, effective arrangement provided to fasten rod at door frame.

WRITE FOR DETAILS AND PRICES. It is never too late to improve your silo. No extra equipment required than you are using.

Ask for literature and prices on galvanized roofs, chutes and ladder.

We are largest distributors of silo rods and lugs in the United States.

All inquiries given prompt attention.

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CORRECT SYSTEM SILOS

Caldwell Silos meet every demand

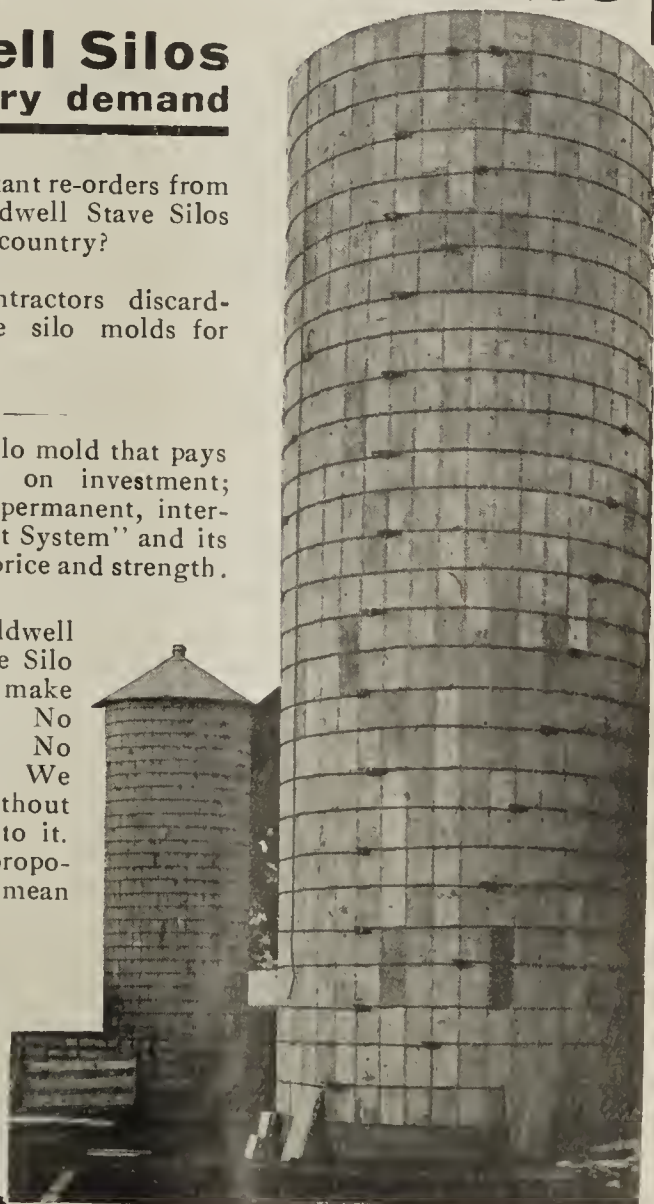
WHY the constant re-orders from farmers for Caldwell Stave Silos throughout the country?

WHY are contractors discarding other stave silo molds for Caldwell's?

BECAUSE it's — the only stave silo mold that pays large dividends on investment; because of its permanent, interlocking "Correct System" and its simplicity, low price and strength.

Buy a set of Caldwell molds and make Silo Staves as you make building blocks. No royalty to pay. No territory to buy. We sell the outfit without strings attached to it. This is a good proposition and it will mean money to you.

**Co-operative
Concrete
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OSKALOOSA, IOWA



Why I Am in the Roofing Tile Business

By Walter C. Hilton

Manager Twin City Concretile Company Minneapolis

Having recently engaged in the concrete roofing tile business, I have been asked, "Why?"

To the casual observer this might seem like inquiring into the self-evident. When a man goes into business—any kind of business—the natural inference is that he expects to make money out of it.

There are usually other compelling motives, to be sure, such as a delight in certain kinds of work, the exhilaration of buying and selling, which in some cases amounts almost to intoxication, and, perhaps, in a few cases, the altruistic desire to fill what is conceived to be the needs of the people.

I think it is pretty generally realized that merely "getting the money" cannot be the sole purpose of any successful business; but that it is the controlling interest cannot be denied. I take it for granted, however, that this does not answer the question; that the inquiry contemplates something of an analysis on my part of my investigations previous to going into the business and on which I founded a belief that it would be a money-making enterprise.

Whether or not we may have any high ideals regarding serving our fellows, such a course is a business necessity if we desire to remain in the commercial realm. The Wallingfords of the world who can get something for nothing are extremely few, and exist principally in fiction or upon the stage, where their activities are attended with fewer risks than is the case in real life.

In considering the matter of roofing tile, therefore, I undertook a careful investigation to make certain whether or not this was a product which the people wanted and which would render them valuable service. I accordingly visited a number of towns where plants of this kind are in successful operation, and was surprised to note how the concrete roofing tile has changed the sky-line in so many localities.

I talked with the owners of buildings which are now equipped and learned of their absolute satisfaction from first-hand. I watched the tile being put on, observing the ease and rapidity of the construction, and noting particularly that the framing of the roof was done only as it would be built for ordinary wooden shingles.

I also talked with the manufacturers of the roofing tile, getting at the cost of production, and learning from them, too, that in many cases they were not able to keep up with the demand.

After this I made a careful study of the present status of the shingle roof. To anyone who has never gone into this in a detailed way, such a study is a revelation. Aside from the fact that the wood shingle has greatly deteriorated in quality during the past few years, while its cost has steadily advanced, until it is scarcely excusable at the present time even from an economic standpoint, I found that the shingle roof has been found guilty by the fire underwriters as one of the chief instigators of our present tremendous annual fire loss. I went over in detail the history of a number of disastrous city fires in which it was shown conclusively that the conflagration would have been confined to a very small area had it not been for the fact that flying embers settled upon tinder-like shingle roofs, thus setting the buildings on fire.

I found, too, that concrete roofing tile was not an

experiment, but had been used in this and other countries for the past quarter of a century.

Taking all these things into account, the only inference I could draw was that as a general proposition the concrete roofing tile was all right. But another thing still remained to be determined.

Was it adapted to our particular local conditions?

In order to determine this I spent considerable time interviewing all sorts of people: architects, engineers, contractors, building material men, owners. The result of this was that even in our own local field I could see nothing against the proposition.

The architects were greatly in favor of it; they were glad to have in prospect a material which they could specify with the feeling that it would add permanence, protection and dignity to a building, and which would not be so high in cost that the owner would insist on having it stricken out and wood substituted instead. Owners, too, have been in the past few years getting their eyes opened to the necessity of cutting down the annual fire loss and so are in a much better frame of mind than formerly to listen to the advice of their architects and engineers for a more fire-restrictive construction.

Engineers were glad to see a material being introduced which would not be so heavy as to necessitate expensive roof construction; and from the material dealers I got figures which proved to me conclusively that I could make a concrete roofing tile which would compete successfully as to price with anything else on the market.

This is the way I went at the proposition. I think anyone who reads this will acknowledge that it was a fairly logical method of investigation; and I think, too, considering the result, they will feel that I was perfectly justified in going into the business.

Millen Cement Plant Sold

The Alpha Portland Cement Company of Easton, Pa., has purchased the plant of the Thomas Millen Cement Company of Jamesville, N. Y. Some 1,200 acres of land are included in the purchase. F. M. Coogan was elected a director and second vice-president of the Alpha Portland Cement Company at a meeting of the board of directors held in New York recently. Mr. Coogan will have charge of the sales department. F. H. McKelvey, former second vice-president, is now first vice-president and continues in charge of the operating department. J. J. Matthes, treasurer, has been elected secretary. Formerly the position of first vice-president in the Alpha company was not an active one and was held by J. M. Lockhart of Pittsburgh. Mr. Lockhart, while retiring from the position, continues as a director and member of the executive committee.

Cement for Road Donated

The Crescent Portland Cement Company of Wampum, Pa., offered \$31,000 worth of cement toward building an improved highway between New Castle and Beaver Falls by way of Wampum. Officials of Lawrence and Beaver counties are now working on the proposal and will push it through if possible.

Repairless Roofs



Walter Concrete Roofing Tiles are going on thousands of roofs whose owners are tired of repair costs. They are buying Walter Concrete Roofing Tiles to stop those expenses. They want a roofing that does not crack or leak. One that will last long after other roofings would have worn out. They find these advantages in Walter Concrete Roofing Tile.

Walter "Concretile"

No other roofing at a moderate price looks so beautiful. Rich, permanent colors that last. Evenly made tile that lay smoothly on the roof. Fire protection, too, no danger from sparks or flying embers—less fire insurance. These are reasons why so many thousands of home owners are demanding Walter Concrete Roofing Tile.

We sell you complete equipment for starting the business. You can add to your equipment as your business grows. We don't sell territory, but we establish only one plant in a locality. We help you get started. We make sure that you turn out a first-class product and we help you create a market for it. Send today for our booklet on the manufacture of Walter Concretile.

Walter Concrete Machinery Co.
418 Saks Bldg., Indianapolis, Indiana

The Multiplex Double Stripper Block Machine makes two Hollow Plain or Rock Faced Block of Wet Mixture at ONE OPERATION



Here is a machine that cuts down the cost of making your building block. In making plain faced block the machine handles a wet mixture and stripping the block out it trowels the sides. The wet mixture compacted under pressure from *both top and bottom*, produces a strong waterproof block which is easily cured. A 150-lb. man on the end of the lever will exert a 40-ton pressure on the block. Two men will make from 700 to 800 blocks per day on this machine.

Write for our latest printed matter explaining the operation of this labor-saving machine in detail

Write for catalog No. 10 and mention Cement News
The Multiplex Concrete Machinery Co., Elmore, Ohio

Same Machine Makes Chimney Block

The Multiplex Stripper may be equipped for manufacturing chimney block as well as building block. Note the flue block shown here with the round smoke chamber in the center, the ventilating chambers in the corners and the tongue and groove joints insuring rigid construction. There is money in the manufacture of chimney blocks alone.



New Concrete Floors Given Supreme Test

Tests are being made by inspectors from the building department to determine the stability of the concrete floors of the American Can Company's new factory building on Railroad avenue, between Clay and Cedar streets, Seattle, Wash. The floors were designed to carry a load of 150 pounds to the square foot. These floors have been loaded with 425 pounds to the square foot, and have satisfactorily withstood this test. The floors were designed by an official of the can company, and the plan is somewhat different from any that have been tested so far by the city building department.

Boxed sheet tin, which the company is receiving in large quantities anticipating the early operation of the big plant, is being used to make the tests, and because of its weight has proved unusually satisfactory for the purpose.

Cement Salesman Dies

Gaston Daus, district sales manager for the Edison Portland Cement Company at Philadelphia, died on April 15 at his home in that city. He was born in Baltimore in 1869. At the start of his business career he was connected with the J. B. King Company, New York City, and later with the Lesley & Trinkle Company, Philadelphia, for twenty-three years, eleven of which he served in the capacity of sales manager. For four years preceding his employment by the Edison company he was district sales manager for the Lehigh Portland Cement Company.

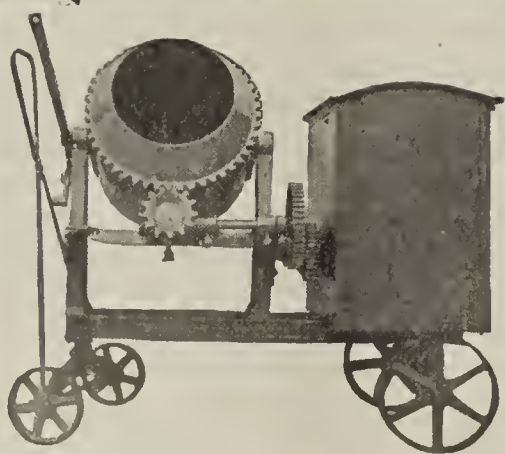
Watering Troughs in Winter

If a concrete watering trough is reinforced there is no likelihood of it cracking due to the freezing of the ground or water. If, however, the walls are vertical and it is kept full of water during the winter, there is likely to be trouble from the water freezing. This can be avoided by placing a block of wood about four inches square in the water with one end weighted so that it will float vertically. This allows the expansive action of the freezing water to force the stick out, thus preventing the bursting of the sides.

Go Into the Business of Tile Draining by Contract

To contractors who are seeking new lines of work and to civil engineers who contemplate entering the contracting business we suggest a study of the prospects of making good profits in the tile drainage of farm lands. In the group of seven North Central states there are nearly 14,000,000 acres of land that is untillable because of the water that lies upon it and in it. But this is only "a starter" when one considers that many times fourteen million acres are under-productive because of excess of water in the soil during some part of the year. Tile drainage has ordinarily cost \$10 to \$20 an acre, but it has yielded an enormous profit on the investment, frequently repaying the entire cost in one season. Bear in mind, however, that practically all tile ditches have been dug by hand and that with a drainage excavator the cost of the ditching can be enormously reduced.

Republic "3" America's Greatest Small Mixer



\$50 and up

Hand or Power

Cash or Time

A Real Builder's Outfit At a Real Low Price

Will mix concrete or mortar, and anything from a very wet to a very dry mix—fine for blocks, brick, tile, sidewalk, curb, gutter, floors, foundations, brick mortar, etc.

So light a couple of men can move it most anywhere—yet strong enough to stand hard usage.

Just the right size and weight for builders, small contractors and block plants and sold at prices you can afford to pay.

Manufacturers of All Sizes and Types

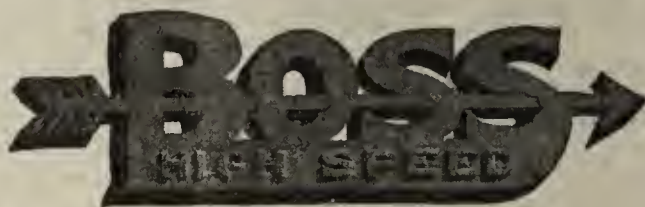
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PAVERS

8-11-15 Foot Sizes
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BUILDING MIXERS

(5-8-11-15-22 Foot Sizes)

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(THE 300,000 HP ELECTRIC CITY)

BRANCH OFFICES—New York, Philadelphia, Pittsburgh, Baltimore, Richmond, Cambridge, Mass.; Indianapolis, Chicago, New Orleans, Minneapolis, Seattle, Spokane, Los Angeles, San Francisco, Cleveland, St. Louis, Louisville.

Mixers Pavers Grouters Hoists

Charges Cement Trust

The so-called cement trust case was expedited considerably recently in federal court when the government and attorneys for the seventeen defendants agreed to submit arguments to the demurrers on brief instead of orally. Under the law the defendants will have fifteen days to file their briefs, the government ten days to answer and the defendants ten days to reply.

The government charges that the defendants formed a combination in restraint of trade for the purpose of monopolizing the cement business of Oregon, Washington and northern California, and by concerted action limited the fields of activity of each company for the purpose of doing away with competition.

The defendants are S. H. Cowell, president of the Cowell Portland Cement Company, and its secretary, W. H. George; F. G. Drum and R. B. Henderson, president and treasurer respectively, of the Pacific Portland Cement Company, and Frank W. Erlin, its secretary; President W. G. Henshaw and Vice-President Tyler Henshaw, of the Riverside Portland Cement Company; George T. Cameron, president, and Fred H. Muhs, manager, of the Santa Cruz Portland Cement Company; John C. Eden, president, and A. A. Sutherland, treasurer, of the Standard Portland Cement Company; A. F. Coats, president of the Washington Portland Cement Company; Alexander Baillis, manager of the Olympic Portland Cement Company, and W. P. Cameron, its general manager, and R. P. Butchart, president, and Clark M. Moore, sales manager of the Oregon Portland Cement Company.

The defendants are represented by an array of prominent attorneys and the government by United States Attorney Reames and Barney Goldstein, one of his deputies.—Portland, Oregon, *Telegraph*.

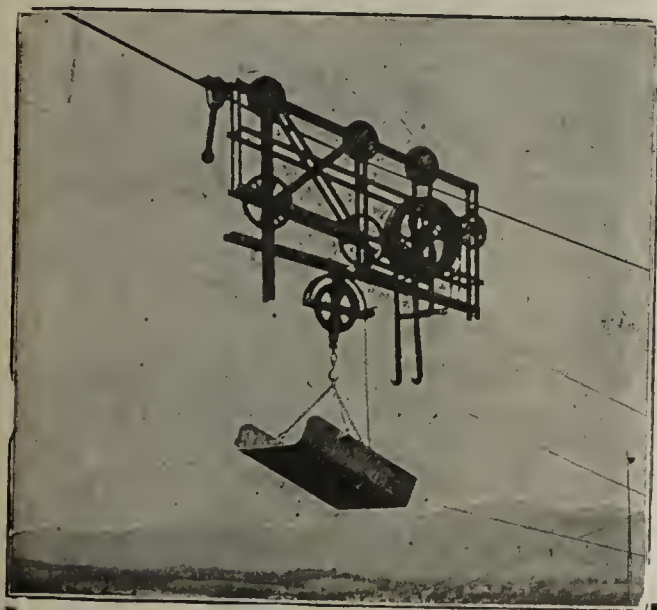
Cost of a Large Blast

About 30,200 cubic yards of limestone rock in horizontal layers from 6 to 28 inches thick, separated by 6 to 8-inch layers of shale, were recently broken at the quarry of the Colorado Portland Cement Co., Portland, Col., by a single shot at a cost of \$2,178. The quarry face was from 39 to 49 feet high and 44 holes 5½ inch diameter were drilled 20 feet apart in four rows to a depth of two feet below the level quarry floor. Each hole was loaded with 265 to 425 pounds of Monobel No. 6 and primed with two No. 7 Du Pont electric blasting caps. They were tamped with sand and one set of detonators was connected in series and the other set in parallel and all fired by a 220-volt B. C. power current. The cost of drilling was \$262 for labor and \$24 for power. The cost of drilling per foot of hole was 13.17 cents. The cost per ton of rock was about three cents for powder and fuse and the amount of rock broken per pound of powder was four

Concrete Culverts

The county cement plant at 643 L street, Lincoln, Neb., where tiles for culverts are made by prisoners and men who are anxious to get work, closed down yesterday, after having put out, at a conservative estimate, 1,600 tiles, varying from 18 to 26 inches in size.

At least four to eight men, down and out and wanting employment, were put to work at the plant every day. It is estimated that the county saves a large sum of money each year by having the tiles made in this way, instead of buying them.



The
**Rugged
Ruggles**

**AERIAL
CARRIER**

Suspended over Slate Quarry

**SELF DUMP
BRAKE LOCKING**

Built in Two Sizes:—1 to 5 tons capacity, 5 to 10 tons capacity.

The **Rugged Ruggles** is made for special use on cement and gravel construction work. For all kinds of quarries where the waste is taken from the pit and dumped at the surface. It will take any load up to ten tons, from any depth to the cable, where it is automatically released and sent either up or down the cable and dumped in mid-air or lowered. One man can operate three **Rugged Ruggles** on as many cables with a three-drum engine:

No brake to wear the cable—Can run on a flat cable.

Simple in construction; made entirely of steel; all the sheaves steel bushed or brass, and is backed by years of extensive use.

Manufactured by

Ruggles Machine Co., POULTNEY VERMONT Dept. C

Concrete Plants, Contractors, Etc.

Secure our confidential processes, methods and formulas and make concrete marble granites, sanitary flooring, etc., and make money.

Write for details

ART STONE CO.

Box 330

Waynesboro, Pa.

CEMENT BLOCK MACHINE

**SOLD ON
15 DAYS' TRIAL**



**Large Capacity
—Small Price**

The Dunn has a capacity of 150 blocks a day—ample for average requirements. Simplifies block making; remarkably easy to operate; makes a wide range of sizes; built rugged to stand hard service. Write for Block Machine Bulletin.

W. E. Dunn Mfg. Co.

414 24th St. Holland, Mich.

The Multiplex Concrete Block Press

Speed, simplicity, durability and versatility are some of the virtues claimed for the Multiplex concrete block machines by their makers, the Multiplex Concrete Machinery Co., Box No. 10, Elmore, Ohio. These machines have been improved and the 1917 models contain many little points of advantage not embodied in those of earlier design.

The company asserts that when a man buys a Multiplex machine, he has gone a long way toward equipping a complete concrete products plant, for the reason that one machine, with its various attachments, can be made to produce hollow block, veneer block, block for a two-piece wall system and a special type of block used in building chimney flues. This question of concrete block chimneys is one that is of general interest to owners of concrete plants, as the chimneys are gaining popularity among builders and have much to recommend them, in preference to chimneys of other materials. The Multiplex catalog contains much of interest to all concrete block manufacturers on special types of block made on standard types of machines.



A Growing Industry

Cement manufacturing in the United States still remains in the class of youthful industries, notwithstanding the fact that it has been climbing steadily up the scale of production for years. Its phenomenal growth is impressively illustrated in the jump it has taken from 250,000 barrels in 1887 to shipments of 94,552,296 barrels in 1916. This growth has not been forced. It has been wholly in response to the natural demand for a building material having the qualities of permanence and greater adaptability.

Back in 1906 some interesting deductions were drawn in regard to the time when the cement industry would reach its maturity. In a report prepared for the United States government under the direction of

Edwin C. Eckel, attention was called to a diagram comparing cement and pig iron production. This diagram embraced what statisticians call "growth curves." It showed cement rising steadily at an increasing ratio each year, with no downward flexures or relapses. "This," explained Mr. Eckel, "is the normal form for the growth curve of a young and rapidly expanding industry." The iron curve, on the other hand, though showing a decided gain for the period covered, also showed at intervals depression flexures "typical," said Mr. Eckel, "of a mature industry whose annual output must now depend on the general financial and industrial condition of the country."

"Within a few years," Mr. Eckel concluded (and this is the deduction previously referred to), "we must expect to see the rate of increase lowered and finally, in some period of business depression, some year will show a lower output than the preceding year. This will mark the end of the youth of the cement industry and the beginning of its period of maturity."

Considering the fact that the qualities of permanence and adaptability are both to be found in the highest degree in concrete, and that it can be produced in any quantity while wood and all other types of building material are becoming scarce, it is not at all unlikely that the growth curves of the cement industry will continue to show steady gains.

Concrete Tombstones

One of the increasing uses for cement this past year has been on tombstones. The concrete tombstone is a worthy brother both in dress and durability to the natural granite or marble stone.

Recently the state of Michigan has erected a large concrete monument to Lewis Cass on the state reservation at Mackinac Island.

Forms from which the stones are made are quite simple, being nearly always "home-made" and of wood. There are very few tombstone molds on the market.

One large monument, metal plates between facing and backing are used and these can be raised as the work progresses.

No other class of work requires such resistability and for this reason special care should be used in getting a well graded aggregate.

Micaspar, Tuckahoe marble, quartz and like aggregates used, should live up to at least sixth degree in the mineralogical scale. By mixing white and gray cement in various proportions, different shadings can be obtained. Marble and micaspar mixed in various sizes can be made to result in any grain or shade from the fine Westerly to the coarse Barre. One part cement to two parts aggregate is thin enough and where bush hammering is to be done, one cement to one and one-half aggregate is better.

Peck Carriers

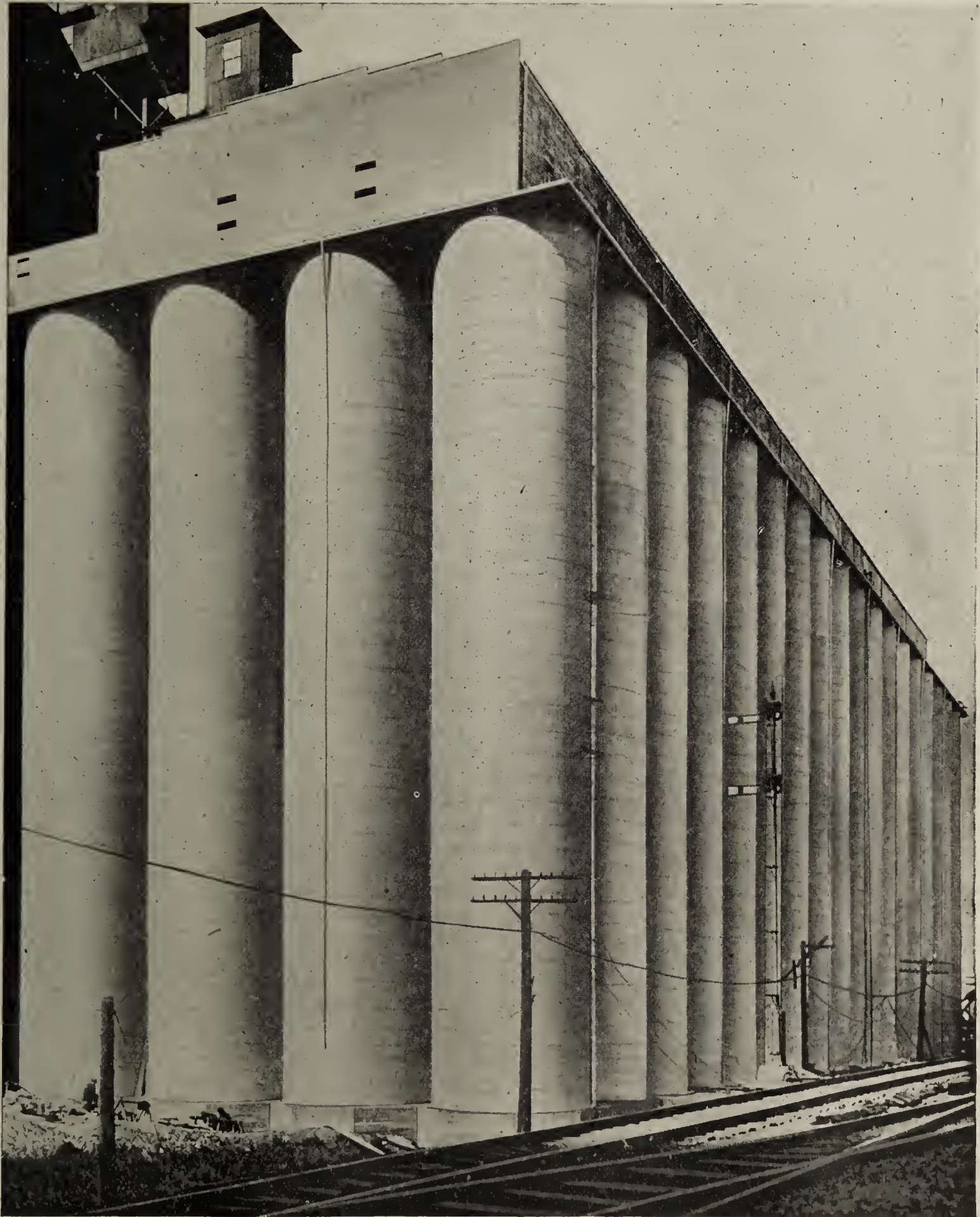
Book No. 120 of the Link-Belt Company, of Philadelphia, Chicago and Indianapolis, with other offices at a number of important points, is devoted to a description of the Peck carrier for handling coal, clinker, ashes, cement, sand, stone, ore and other materials. The book has more than 100 pages and it is fully illustrated, the pictures being distributed throughout the very interesting and instructive reading matter. It is stated that the Peck carrier is of the highest development of gravity bucket type. Its design, details of its construction and the accuracy of its workmanship are all superior.

Cement and Engineering News

Vol. 29

August 1917

No. 8



New Concrete Grain Elevator at Superior, Wis. 30,000 Barrels Cement Used. Great Northern Ry., Owners. Barnett & Record Co., Engineers, Minneapolis.

Dust in Cement Mills From An Economic Standpoint

Very considerable economies can undoubtedly be introduced in many of the mills, and one of the most far-reaching of these is the collection and utilization of the dust which is, in a great many cases, allowed to float off from the plant in a vast cloud and become a total loss.

In considering this matter we have a number of items on the credit side which are apt to be overlooked in the superficial consideration usually given this problem. In fact, the quantity of material collected is apt to be very much discounted by those who have not thoroughly investigated the amount lost. The theoretical quantity required is easily determined by the chemist. Very few mills keep an accurate record of the actual output of their quarries and are thus not in a position to determine accurately the loss of material in the different processes. Very little work has been carried on along this line. The Germans have collected from 2% to 4% of the total output of the plant in dust collectors. We know that they are very much more particular about covering the conveyors and such methods of preventing the dust from escaping. There are undoubtedly plants in America in which dust conditions are very good. Even the absence of the dense cloud of dust does not indicate that no loss occurs. In one case a saving of from 1% to 1.5% was made in which the loss was apparently insignificant.

This work along the line of dust prevention rather than the collection after it has escaped, is probably more to the point at the present time. The cost of the changes necessary to effect the saving is frequently very small, in comparison with the value of the material, as so much raw mix or finished cement. Each mill will present its individual problems to be solved and any general figures will thus be worse than useless.

Dust Affects Labor Efficiency

The labor item is of increasing importance in all industries. To the initiated, the sight of a gang of men groping around, in a haze of dust, amid moving belts, shafting and other machinery, is not so uncommon as it should be. These men are decidedly not working in an economical manner. They must frequently come out and get fresh air. The hazard of working in these conditions naturally slows up the work. The same degree of thoroughness is not likely to be carried out as would be the case under more favorable conditions. Future repairs will be called for more quickly. Work in dusty places is very apt to be overlooked and avoided as long as possible. The men are not satisfied and a great deal of trouble will usually be encountered in obtaining labor in dusty mills.

Dust Increases Repair Cost

Just how much of the repair cost would be eliminated by the reduction of the dust nuisance would be very difficult to estimate with any degree of accuracy. The accumulations on the roofs of the buildings and other places around the plant have to be cleaned up occasionally. This involves expense in the collection and disposal of the accumulations of material on which considerable time and money have been spent.

There is no doubt that an entire elimination of dust from a cement plant is too nearly an ideal for serious consideration. The practical solution of this question must be made sooner or later in this country. Some of the plants, notably those in California, have been forced to take up these matters and solve them. A

few steps voluntarily taken in this direction will go a long way in avoiding the type of legislation which results in serious financial hardships.

County Owns Its Own Concrete Pipe Plant

In two and a half years a manufacturing plant, owned and operated by Woodbury county, Iowa, has turned out 29,925 feet of concrete culvert pipe for the use of the county engineering department in road development. The plant is the Woodbury County Concrete Pipe factory at Correctionville, Iowa.

If the pipe, which has been turned out through an initial expenditure of only \$6,500, were placed end to end, a sewer could be built starting at the court house in Sioux City, and extending to Sergeant Bluff. And the initial expenditure is good for four times what has been produced already.

Realizing the advantages of permanent concrete construction in developing the roads and drainage in this county, early in 1914 County Engineer McLean laid plans for a factory utilizing the gravel fields at Correctionville, and saving to the county profits of the dealers. The Correctionville plant is the result, and since its erection permanent construction has been used in the 100 bridge projects of the county.

Too much money? Here are the county engineer's figures. A 30-inch concrete pipe made in the county's factory costs 1.2 per linear foot; corrugated pipe of the same size comes to 3.2; cast iron costs 6.1; and boiler pipe can be bought at 5.1. Figure that out on a basis of 30,000 feet production, and it is seen that in two years a huge hole has been cut in the initial cost of the plant, to say nothing of the permanence of Woodbury county's construction.

"Undoubtedly the comparatively low unit costs obtained at the Woodbury county plant during the past two years," says Engineer McLean, "have appeared low in comparison with the excessive cost of metal pipe under the present market conditions. This comparison in normal times would not show such marked advantage in favor of the concrete pipe."

However, McLean is not a concrete pipe crank. He does not consider the concrete culvert as a panacea for all the evils of other types of construction. He takes note of the added cost of hauling and placing the concrete culverts, the carrying capacity of a pipe as compared to a box, and the feasibility of placing pipe in an uneven terrain. Many of these disadvantages have been studied and in a measure overcome. A reinforced concrete base is many times put in for joints to rest upon, where otherwise the base would be soft, shifting the culvert out of alignment.

But McLean is satisfied with the investment, and the recognition of the Iowa highway commission and journals of the nation testify to advantages of the plan.

Dairy Barn Cement Work

The Loudon Machinery Co., 5903 Broadway, Fairfield, Iowa, has issued an interesting work entitled "Louden Barn Plans" containing 112 pages of practical information relating to the subject indicated. There are more than fifty plans of barns and other farm buildings and the book treats of every phase of modern barn construction, drainage, concrete work, lighting, ventilation, etc. The published price is \$1, but the company states it is free to those who build barns. Mention CEMENT AND ENGINEERING NEWS when writing.

Watertight Basement Construction

It is not generally known by many builders that the watertightness of concrete construction depends entirely upon the observance of good concrete practices, says H. Colin Campbell in the Bulletin of the Philadelphia Master Builders' Exchange. Watertightness is closely related to density and both are secured by so proportioning the various materials of which concrete is composed as to eliminate the voids or air spaces in the fine and coarse aggregates. For the greatest refinements of void elimination, rather elaborate tests are necessary so that it may be known with exactness the volume of sand required to reduce the voids in the pebbles or broken stone to the lowest possible limit.

Another determination will disclose the quantity of cement necessary to practically eliminate these voids. As a matter of fact, such refinements are not practiced in actual field operations except where the work is on a large scale and the saving in cement would warrant such extreme refinement. Rather, it is the practice to use arbitrary mixtures which have been proved by experience will produce desired results.

The theory of proportioning concrete requires that every particle of sand shall be covered by a film of the cement-water mixture and that every pebble or particle of broken stone shall be completely surrounded by the sand-cement mortar. To insure this it is necessary to slightly overfill voids. For instance, a 1:2:3 mixture is an example of proportions that insure this overfilling:

This is an extremely reliable mixture to use where anything like a slight head of water is to be opposed—such, for instance, as where after protracted rainy spells the normal ground water level would rise and for a time remain above the level of a basement floor. Of course, under such circumstances it is quite necessary that the concrete floor shall have been constructed with a view to also combating this condition, which implies sealed joints between floor and foundation walls and sealed joints between individual slabs of the floor, unless the floor is constructed as a monolith.

Leaks in cellars and basements are not always the result of porous concrete due to improper proportioning of materials, but are frequently the result of leakage through seams that mark the stopping points of various days' work. Unless suitable provisions are taken to prepare these places properly when concreting is resumed, there is sure to be a leak through the wall along such planes.

Another cause of leaky basements or cellar walls is due to improper consistency of the concrete and to improper placing of it. For most classes of construction the correct amount of water in a concrete mixture is that which will make a concrete of quaky or jelly-like consistency. Such concrete when placed cannot be tamped because of the amount of water which it contains. Blows of the tamper will dislodge it, therefore it is placed by spading in the forms and in this way settled to utmost possible density.

Experience has proved that where sand is only moderately damp when combined with the other materials in a concrete mixture, the quaky or jelly-like consistency can usually be produced by using water in the proportion of one gallon to one cubic foot of concrete in place. This figure is not intended to represent a fixed rule, but rather an approximation of the amount required.

One of the greatest faults of much concrete field work is that contractors, merely to cheapen the cost of placing and otherwise facilitate operations use a concrete containing too much water. The practice of spouting concrete into place has largely been respon-

sible for this. Concrete mixtures that are too wet are as objectionable in some ways as those which are too dry. There is almost certain to be a separation between the coarse aggregates and the sand-cement mortar when placing, and such separation produces pebble pockets or spots in the construction that lack required density.

Even though concrete mixtures may have been proportioned so that the combined materials contain the lowest possible volume of air spaces or voids, and also represent a mixture rich enough for strength, the resulting concrete will not be watertight unless it was mixed to the right consistency and properly placed.

Too early form removal and exposing the concrete to hot sun and drying winds also tend to reduce its watertightness. The concrete is robbed of water necessary to the chemical transformation of the cement, so that one other means to watertightness, after all others have been observed, is to protect the concrete for several days by keeping it moist.

Mixing a small quantity of hydrated lime with the other materials used in a batch of concrete will increase its watertightness. From 5 to 10 per cent of hydrated lime has been used effectively in this manner. It is generally believed that not more than 10 per cent is safe, because of the possibility that the strength of the concrete will be affected.

Business for You in the New Color Stucco

For several years there has been a strong tendency toward stucco in home and garage construction—a tendency so well defined as to attract the attention of every wide-awake contractor.

There are good reasons: Low first cost, lowest maintenance, fire-resistance, comfort, beauty and distinction make a combination that's hard to beat.

Now the tendency is even stronger, the reason even better—namely, the new color stucco.

Our new color stucco, toned with marble or granite screenings or colored sands or gravel, has all the practical advantages of gray or white stucco—and even more beauty and attractiveness, writes the Atlas Portland Cement Company. It has the one quality that is most desired in a home—variety of tone instead of a flat tone. The results are a great improvement over what has been done before.

The demand for this new color stucco is certain to be large. To help you take it up now and to help you know how to do it right, we have prepared a new edition of the "Guide to Good Stucco," full of practical information and yours for the asking.

The methods approved by our successful experiments are summed up in this book. It gives you at once what we had to work over a long time.

It deals first with materials, mixing, construction on lath, with and without sheathing, and on brick, stone, tile or cement blocks.

Colored aggregates are not hard to get. The "Guide to Good Stucco" contains a list of sources. Probably you can find what you want near your work. If you can't, the cost of getting it from a distance won't be much, for an average size house requires only two cubic yards of colored aggregates.

There are also included specifications for color stucco and illustrations in full color and scale of the new colored aggregate stucco.

Write today for your copy of a "Guide to Good Stucco" to The Atlas Portland Cement Company, New York or Chicago.

Rebuilding Susquehanna River Bridge, Harrisburg

Replacing a Single-Track Truss Bridge Under Traffic by a Double-Track Concrete Arch Structure on the Same Piers

The old Cumberland Valley R. R. bridge across the Susquehanna river at Harrisburg, Pa., with 25 truss spans, most of them averaging 175 ft. in length, has just been replaced by a continuous double-track structure on the same alignment with one long plate girder span over the Pennsylvania R. R. tracks and 45 concrete arch spans of 59 to 77 ft. The new structure, 4,000 ft. long, has a grade about one-half of one per cent, is built partly on new piers and partly on the old piers 34 ft. long on top.

Substructure Work

The new piers, intermediate between the old ones, were built in 16 cofferdams and the old piers were modified by enclosing them in concrete jackets reinforced by horizontal and vertical steel rods anchored to the old masonry by bolts drilled into the stonework about 6 ft. apart in both directions at the intersections of the bars. The concreting of the old piers was done

dinkies on a narrow-gauge track on the service trestle built across the west channel adjacent to the south side of the new structure. The trestle bents were made of round logs and had sills seated on the bottom of the river. They supported 15-in. I-beam stringers of 16-ft. span on which were laid ties carrying four lines of rails making two 3-ft. gauge and one standard-gauge tracks. The concrete cars were run on the narrow-gauge tracks and the buckets were dumped into the pier forms and later into the arch forms by two 25-ton locomotive cranes, one of which had a very long boom and the other had a boom with a 12-ft. gooseneck. The cost of the service trestle was about \$12.35 per linear foot.

The piers were concreted up to the springing line about 5 ft. above the top of the trestle after which umbrella forms were added and the projecting skewbacks cantilevered out before the arch centers were



Nearly Finished South of Bridge from East End. Service Track in Foreground. Locomotive Crane With Goose Neck Handling Pier Forms. Arch Centers in Position.

in sandbag cofferdams built in the shallow water on the rip-rap protecting the pier footings and kept dry by vigorous pumping. Both wooden and steel forms were used and the tops of the piers were cantilevered out umbrella fashion to form skewbacks receiving the arch rings.

Moving the Old Superstructure

In order to maintain traffic during construction, the new bridge was built in successive longitudinal halves and before the archwork was commenced the old spans were moved 8½ ft. transversely on the old piers to clear the new work. The spans over the east channel of the river were first moved in one operation; those over the west channel were moved in a second duplicate operation. The ends of the spans were jacked up high enough to permit inserting under them sets of 29 7/8-in. steel rollers on 75-lb. rails transverse to the bridge axis, after which a 35-ton jack was operated at each end of the span and pushed the bridge 12 in. at each operation, working together by signal until it was necessary to release the jacks and block them up for another movement, the whole operation occupying about 8 hr. The jacks reacted against a horizontal timber yoke enclosing the top of the pier.

Concreting

The aggregate was delivered on a trestle adjacent to the bridge and dumped from it into storage bins of 250 yd. capacity that discharged by gravity into Haines mixers delivering to 1-yd. buckets hauled by gasoline

placed. The concrete was handled at a cost of about 50c per yard.

After the completion of the west half of the south side of the bridge, the service trestle was moved to the east channel and the work there was executed and the trestle again moved to the east end of the north side of the bridge, the intention being to build the north half in the same way as the south half by re-using the same trestle. This plan, however, was modified by the fact that a flood in June last carried away the trestle and badly damaged the I-beam stringers, some of which were bent around the piers so that it was necessary to rebuild the trestle for the west end of the north half and to straighten the I-beams before they could again be used. The I-beams were successfully straightened by heating them, convex side up, in old rail cradles over wood fires that softened the metal so that it gradually settled down to approximately straight lines under its own weight.

In the construction of the new substructure, seven deep rectangular recesses were formed in the concrete on each side of each pier just below the springing line to receive the bearings of the steel falsework trusses that served as arch centers during the concreting. The center recess of each group was made wider than the others to permit the location of an arch truss first on one side to support the edge of one longitudinal half of the superstructure, and then a few inches distant on the other side to support the edge of the

adjacent second half of the superstructure.

The arch centers were riveted steel trusses of the Blaw type and were adjustable so that they could be used for both 74½-ft. and 77-ft. spans, of which there were 21 of each. The ends of the trusses were seated on pairs of wedges on 12x12-in. transverse sills supported on heavy temporary steel brackets seated in the recesses and securely bolted to the masonry.

After the trusses were erected and braced securely together, they were covered with two thicknesses of 2-in. lagging planks with an upper surface of 24-gauge black sheets that gave a smooth and uniform finish for the arch soffit. The sidewalls of the forms were built up and the concrete was placed in them by the locomotive crane and by a pneumatic placing apparatus depositing the concrete first at one end of the arch and then at the other end with intervals of less than half an hour so that the entire 260-yd. ring, 16 ft. wide for the first half of the bridge, was poured in from 10 to 12 hr.

The remainder of the superstructure was built up to the coping line and a reinforced longitudinal wall 2 ft. thick was built along the north edge of the south half of the arches to serve as a temporary retaining wall to hold the rock fill deposited to level up over the top of the arch ring, above which ballast was placed and the tracks laid. Traffic was transferred to the new structure, the service trestle was shifted to the north side of the bridge in the east channel, the old superstructure there was removed by the locomotive crane, and the north half of the superstructure was built first on the east and then on the west channel as already described.

Shifting the Arch Centers

The arch centers for the longitudinal halves of the span were handled as units, four truss ribs, their bracing, and the lagging being shifted from one span of the west channel to one in the east channel and from the south side of the east channel to the north side of the same channel and thence from the north side of the east channel to the north side of the west channel, completing the work. In shifting from the west channel to the east channel and vice versa, the adjustment wedges at the end bearings were slacked off, lowering the center framework about 16 ft. wide and 74 or 77 ft. long to bearing on live rollers on the 12x12-in. sill timbers that were extended to a pair of tracks on the narrow-gauge service tracks at both ends of the truss. The center was then pulled transversely out from under the arch ribs until it was supported on the trucks, by lines operated by the locomotive crane. The trucks were then pushed to the new span and the center rolled transversely back to position by lines operated by the locomotive crane, the entire operation of shifting from one position to the other requiring about 6 hr. and costing about \$27.50.

In shifting the centers from the south side of the east channel to the north side of the east channel, no longitudinal movement was required and the centers were simply rolled about 16 ft. transversely on the supporting sills that extended the full length of the piers.

The old steel superstructure was shifted on the piers by the Pennsylvania Steel Co. The construction of the new bridge was commenced in March, 1915, and was completed in the summer of 1916 by the Robert Grace Contracting Co., A. P. Hucker, general manager.

Steel Truss Centers

For this job there were furnished by the Blaw Steel Construction Co. ten spans of steel centers, built as three-hinged arches. Each consisted of four trusses spaced 4 ft. 8 in. apart.

These ten spans of centers were used 80 times

which gave eight uses of each center, on an average. Generally steel centering is only used half this number of times and the concrete is placed right on top of the wooden lagging, but in this case it was found profitable to the contractor to cover the lagging with thin steel plates nailed on, thus avoiding the trouble that sometimes occurs when wooden lagging is used repeatedly, due to the fact that the wood warps between the different uses. Furthermore, it gave a little better appearance to the concrete.

The centers were adjusted to take the two different spans of 74½ and 77 ft. by simply letting out on the lower tie rods and wedging up the lagging from the steel centering to the exact curvature.

The centering was supported on steel brackets bolted to the piers and rested in recesses left in same. For the shorter span the centering rests on this bracket



Steel Umbrella Forms for Piers and Concrete Buckets
Handled by Gooseneck Derrick Boom.

close to the pier; on the longer span they were moved 15 in. further away from the pier.

The centers were collapsed and rolled sidewise on trucks to the desired location in one operation at a big saving as compared with the usual method of unbolting the centers, handling them in small pieces, and re-erecting them.

Steel Forms

There were two types of Blaw steel pier forms used. One was for placing the 12-in. coating of concrete on the old stone piers, and consisted of standard steel lagging fastened to steel uprights and held by means of steel rods grouted into the stone piers. These forms were handled either by means of locomotive derrick in big units, or in smaller lifts by hand wherever conditions made this necessary.

For the new piers there were furnished complete steel forms adjustable to the different heights of the piers. These forms were handled by means of the locomotive derrick whenever available, or by means of block and fall from the railroad bridge above.

The pier forms were used to the springing line and for the curved part of the pier, or umbrella, forms were supported on the steel brackets, later used for the steel arches. These forms were held together by means of tie rods running from one side to the other and braced on top with wooden struts. The handling of these forms was done by means of traveling locomotive derrick.

CEMENT AND ENGINEERING NEWS

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Advertising copy or changes in ads. must be in this office by the 25th of each month, as hereafter our magazine will appear on the 5th of the following month

Advertising Rates Sent on Application

JOHN F. WALDRON - - - - - Advertising Manager

CHICAGO, AUGUST, 1917

Cement Industry in First Half of 1917

The first half of 1917 has been a period of great activity in the Portland cement industry. Production and shipments from practically all mills have considerably exceeded those for the corresponding period of 1916, according to E. F. Burchard, of the United States Geological Survey, Department of the Interior, and prices are now higher than they have been for 19 years. The present strong demand for cement is reported to come principally from small consumers, many of whom are in agricultural districts, although, as usual, much cement is going into roads and pavements.

The war in Europe has apparently not yet much affected the demand for cement. Factory construction has taken a moderate quantity, but the demand directly for military purposes seems not to have been notably great, although it will doubtless become greater as the war progresses and as the United States takes a larger part in it.

The prices of cement, however, have been greatly influenced by the war. The increase in the cost of fuel has been out of all proportion to the increase in the selling price of cement. It is reported that of late the fuel cost per barrel for burning clinker in the Lehigh district has been greater than the entire cost of manufacturing cement three years ago. Everywhere also the increase in the cost of labor, mill supplies, machinery, explosives, bags, and other things essential to the cement industry are reported to be proportionately greater than the increase in the selling price, so that manufacturers are not obtaining large profits.

Though wages are generally good there is scarcely a cement plant which is not suffering from shortage of labor. Freight embargoes and car shortages have also retarded or prevented shipments of cement to certain markets and have hindered or interrupted the operations of most mills through delays in the delivery of fuel and mill supplies.

Whether or not the output for 1917 will break the previous high record—that of 1913—can not now be predicted. The month of June has shown a slight abatement of demand from small consumers in certain districts, attributable in part to the entry of the United

States into the war, to the prospect of increased taxation, and to the purchase of Liberty bonds. General building and improvement work is likely to be curtailed or postponed at times of high prices and uncertain deliveries. It is possible that there may be increased demand for cement for military uses, but any increased demand is likely to be local rather than general.

The Subscription Price of Trade Papers

Suppose trade papers were to charge subscribers what it costs to produce them. They would have to charge about three times the present rates. Would men pay \$9 a year for the trade papers they now get for \$3? Some would; many would not. But the trade papers are, most of them, worth more than three times their cost to their subscribers. As a matter of reason, why should they not charge what they are worth? Probably not a reader of any good trade paper but gets the worth of what it cost him for a year in one article in one issue. Why, therefore, should he not pay at least what the paper costs to produce? Somebody can answer this query in some other manner than to say simply that he won't. He won't because he has never been asked to, for one reason; but it is not the conclusive reason. He won't because he does not have to, is not a reason at all, but is the excuse the readers themselves are content with. Nothing in business is sold for so small a proportion of its value as the good trade paper.

University Course in Concrete

The University of Chicago, recognizing building progress and industrial requirements, offers this year a summer course in concrete development in way of lectures by engineers and teachers familiar with the concrete industry and the subject of concrete as taught in manual training and vocational courses. These lectures are open without charge to all interested. They will be given, indeed they are already under way, in Belfield hall, room 159. Five lectures have already been given on concrete materials, proportioning concrete mixtures and mixing and placing concrete, making concrete water tight, tools and equipment for the concrete course, wooden molds for small objects. The remainder of the course continues with a lecture on concreting practice, July 9, at 4:45 p. m. The course will be concluded according to the following schedule:

July 13, 4:45 p. m.—Concreting practice.
July 16, 4:45 p. m.—Principles of reinforcing.
July 16, 5:30 p. m.—Practical calculations.
July 20, 4:45 p. m.—Surface finish.
July 20, 5:30 p. m.—Curing concrete.
July 23, 4:45 p. m.—Plaster and glue molds.
July 23, 5:30 p. m.—Demonstration by boys of concrete class of Mooseheart Industrial Institute, Mooseheart, Ill.

Special Finishing Tools

A concern which has made a special study of finishing tools for concrete work is the Abram Cement Tool Company, McNair Bldg., Detroit.

A specialty is made of long-handled tools for side-walk work. Those who are interested in this kind of work should send for a catalog, which shows a number of combinations at different prices, the combinations being so regulated in variety and price as to fit the needs of contractors doing various kinds and amounts of work.

Costs of Concrete Elevators, Tanks and Silos

A large amount of reinforced concrete construction that has recently been built by George W. Quick & Sons, Tiskilwa, Ill., includes grain elevators, bins, tanks, and other buildings and miscellaneous structure.

These contractors have specialized tall grain elevators for community interests and silos for individual farmers throughout the country. A typical example is the farmer's elevator at Niantic, Ill., which has four bins 18 ft. in diameter, four approximately 12 ft. sq., all 50 ft. deep, with a ground level driveway between them and bins 32 ft. deep above the driveway, the whole being surmounted by a 32x32-ft. house 30 ft. high and providing for the storage of about 60,000 bu. of grain. The superstructure was supported on a monolithic concrete foundation slab 54 ft. sq. and 20 in. thick, and was built at a cost of about \$13,000.

The Sullivan elevator has a 48x36-ft. main building 113 ft. high to the floor and 213 ft. high to the roof, which is seated on top of the main bins 100 ft. high. The ear-corn department has a capacity of 5,000 bu. of ear corn or 10,000 bu. of shelled corn in four 20x24-ft. bins.

A concrete silo in Tiskilwa is 14 ft. in diameter and 40 ft. high, with a water tank of the same diameter and 10 ft. in height on top.

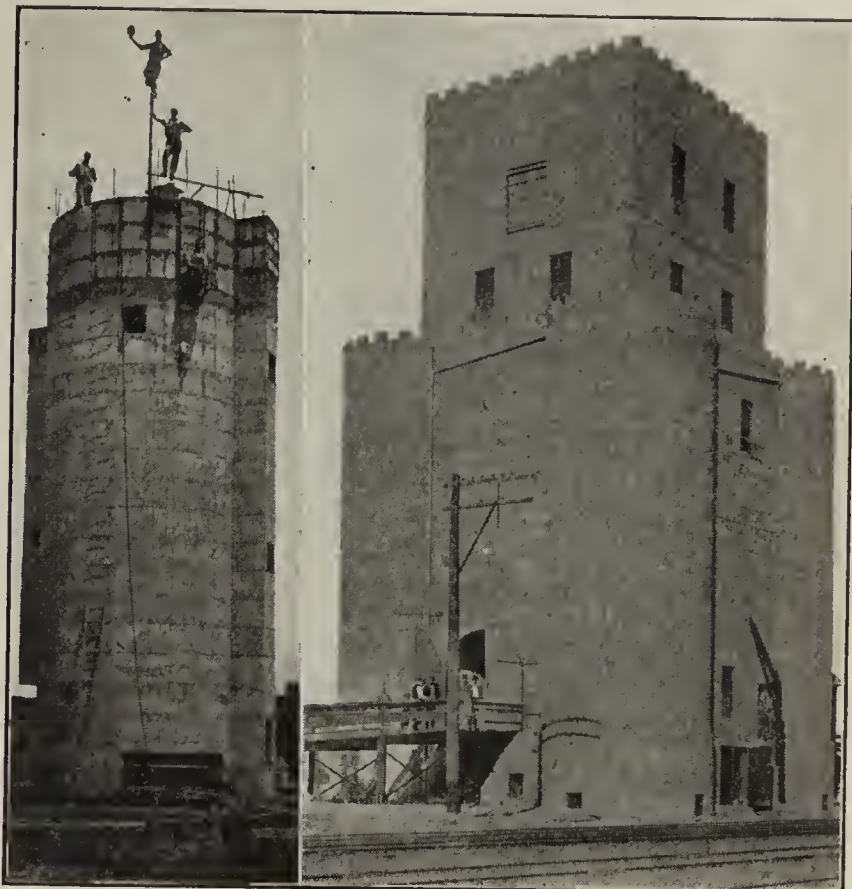
The circular bins are cast with outside steel forms made by the Polk-Genung-Polk Co., Fort Branch, Ind., who also furnished the hoisting equipment used in this construction. The straight walls are cast in wooden panel forms made by the contractor, who also manufactures the wooden spouts for chuting the concrete.

The average cost for circular silos with 6 in. walls is \$10, \$14, \$16, \$18, and \$20 per foot in height for

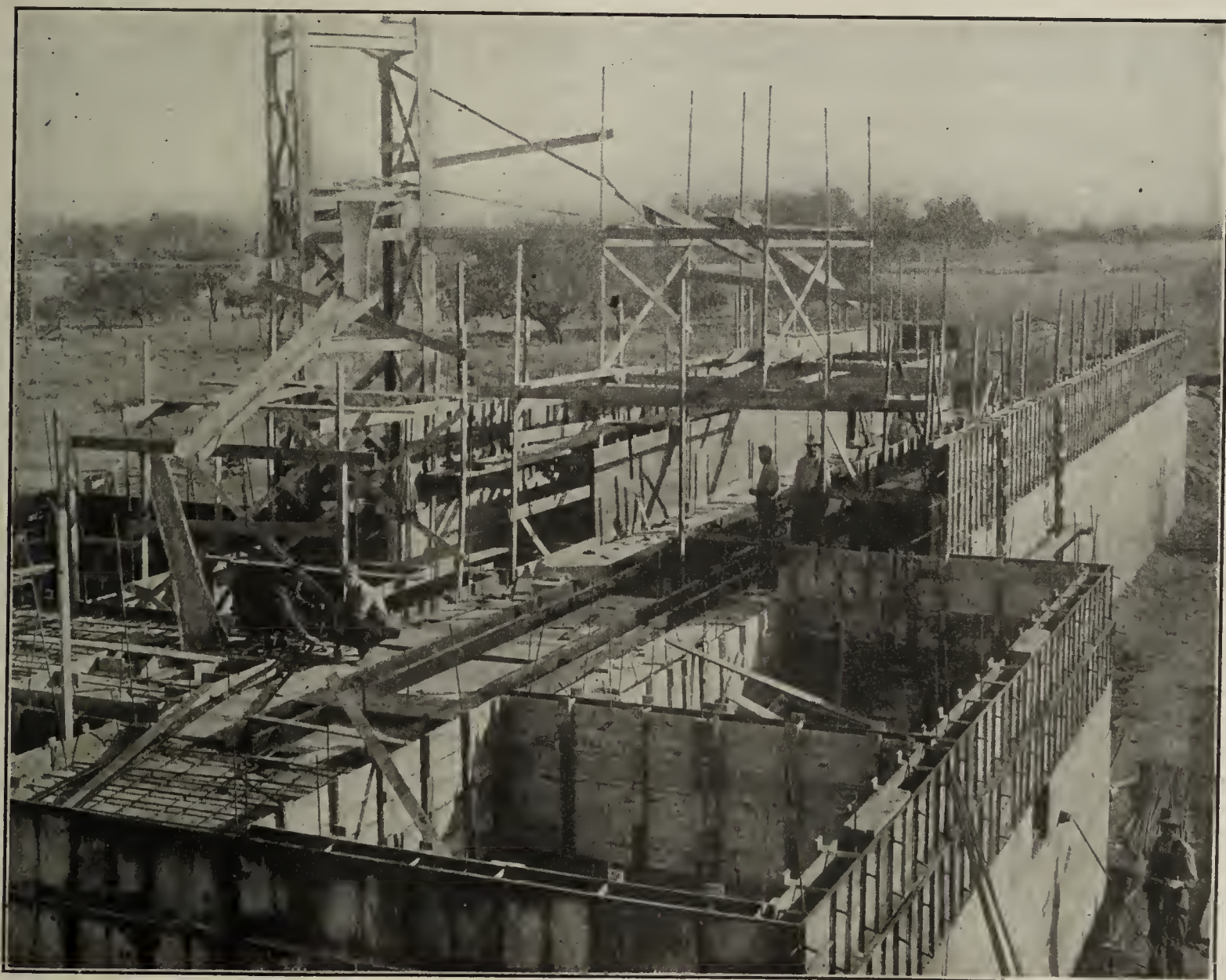
corresponding diameters of 10, 14, 16, 18, and 20 ft. The cost of water tanks is about \$2 per foot greater. The cost of elevators is from 20 to 25 cents per bushel of capacity.

Cement Pipe

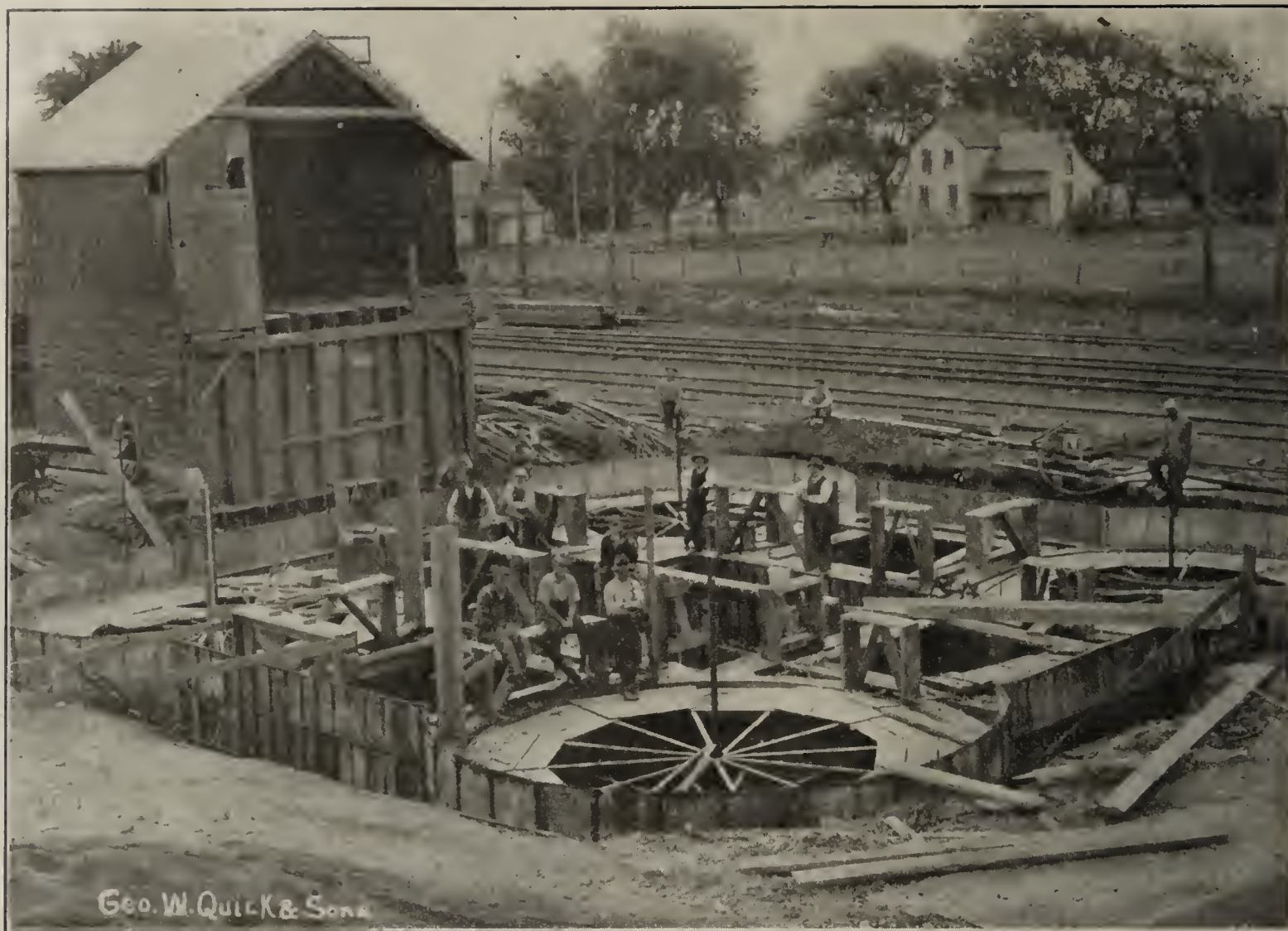
Centerville, Cal.—Contract for furnishing about six miles of 24-inch cement pipe for Graves Bros. has been awarded to Concrete Pipe & Construction Co., Porterville, Calif.



Silo Built With Steel Forms. 60,000-Bu. Grain Elevator.



Pouring Concrete in the Outside and Bin Walls of the Sullivan Elevator, 213 Ft. High.



Building 60,000-Bu. Concrete Elevator With Steel Forms for 18-Ft. Circular Bins.

Concrete Burial Vault Industry

The use of concrete burial vaults during the last few years has increased at an astonishing rate, and the next few years will witness even a greater increase in the concrete vault business than has been witnessed during the past. There are a number of reasons for this, among which might be mentioned that the development of the concrete industry has created a demand for concrete products of all kinds—burial vaults included. Then there has never been a period during which the undertaking profession has made as great progress in all of its departments as it has made in the last ten years, consequently a much higher grade of funeral furnishings of all kinds are being used now than ever before, and therefore there has been an increased demand for a higher state of perfection in burial vaults. Then again, the public in general is being educated out of the old-time method of burying with only an ordinary wooden box to protect the remains, and along with this education has come a spirit of investigation on the part of the people as to what kind of a burial vault is best. The result of all this is that the concrete vault is more in demand than any other.

The Automatic Sealing Vault Company, of Peru, Ind., has not been slow in realizing the truth of the above statements and has spared neither time nor money in bringing its automatic sealing vault up to the highest standard of perfection.

The Automatic sealing vault is constructed on a plan entirely different from any other concrete vault, as no cementing of any description is necessary to exclude the water. The automatic seal is secured by the simple act of placing the cover in position on the body of the vault, which extends up into the cover in such a manner that when the water in the grave rises to a certain height the air is sealed within the vault; consequently no water can enter, as two bodies can-

not occupy the same place at the same time. These facts give the Automatic sealing vault individual characteristics which places it in a class entirely to itself.

Although the Automatic sealing vault has been on the market less than six years, yet they are being sold today by hundreds of undertakers in more than one-half of the states of the Union, and have even found their way into countries outside of the United States and have given universal satisfaction wherever they have been introduced.

One of the principal departments maintained by the Automatic Sealing Vault Company is devoted to the manufacture of adjustable steel molds for the molding of their Automatic sealing vault.

These molds are made of Bessemer sheet steel and are adjustable to fifteen different sizes of vaults, with a capacity of one vault per day. Great care has been exercised in designing these molds. Each section of the molds is made from a single sheet of metal. The manner in which the metal is bent to give the proper shape makes the molds extremely rigid and where extra strength is required the sections are reinforced with angle braces secured in such a manner that all surfaces coming in contact with the cement are free from rivet heads and all other irregularities.

In assembling these molds the different sections are held in position by means of rods and key pins, the use of bolts, nuts, screws, and turnbuckles having been discarded, thus relieving the vault manufacturer of much inconvenience and annoyance.

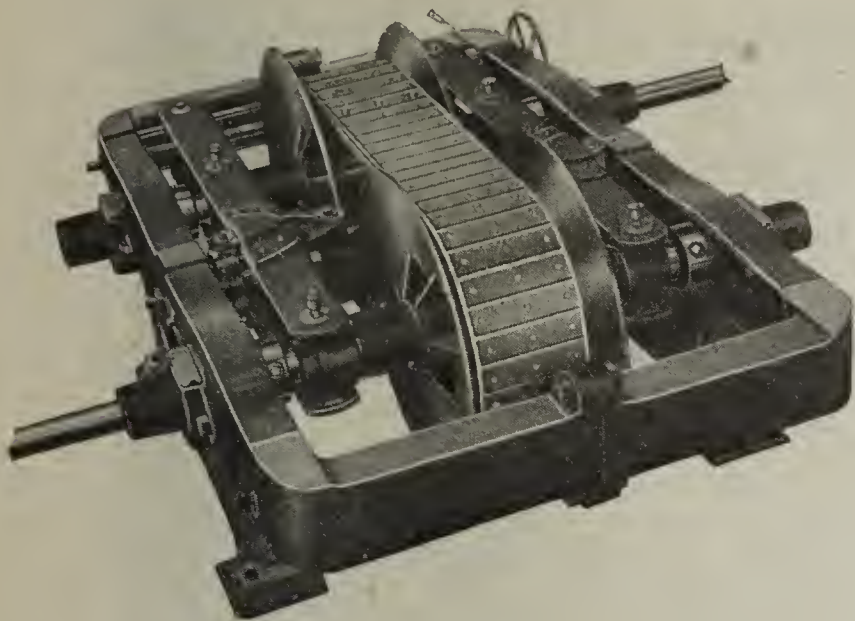
Any person who is interested in the manufacture of burial vaults will find it to his advantage to write the Automatic Sealing Vault Company, 216 East River street, Peru, Ind.

A Portland cement plant began operations in Guatemala April 1. It is financed by American capital and cost \$250,000. Cement made there can be sold for less than \$4 a barrel, about half the cost of imported cement.

Reeves Variable Speed Transmission

A description of the construction and operation of "The Reeves" variable speed transmission will, no doubt, be of interest to our readers. The essential feature is that two pairs of cone disks are spline mounted on two parallel shafts. These disks are operated by a pivoted bar which is operated by a screw in such manner that one pair of disks is brought together while the other pair is forced an equal distance apart. At the same time a uniform tension of the special belt is maintained. Efficiency from 80% to 95%, according to conditions of the service.

The inner sides or faces of the disks form a V-shaped groove into which is fitted an especially designed belt,



having its bearing surface on the edges instead of the bottom, as with an ordinary belt.

One set of disks acts as driver and the other driven. As the disks are actuated so the belt assumes the large diameter on one pair of disks, it at the same time assumes the small diameter on the opposite pair, thus increasing or diminishing the speed of the driven shaft, and giving any speed between the two extremes of variation.

"The Reeves" Variable Speed Transmission is installed in the same manner as an ordinary countershaft and may be placed on the floor or suspended from the ceiling as desired.

It may be applied to any machine or mechanical device whatever requiring variable speed, such as Iron Working Tools, Dryers, Cement Machinery, etc. There is the proper speed at which all cement machines and appliances should operate, but it is rarely the case that means are provided whereby this proper speed can be obtained. "The Reeves" Variable Speed Transmission is the "missing link" that accomplishes this most desirable end.

It enables the operator to get the most exact speed desired at a moment's notice for his cement kiln, coal feeder or any other cement machinery without in anywise interfering with the operation of the machine which it controls. It is so simple to operate that even an unskilled mechanic can manipulate it.

In the modern plant of the Wabash Portland Cement Co. (illustrated and described in the June issue of CEMENT AND ENGINEERING NEWS), the supply of coal used in the kilns is regulated by a small No. 2 Reeves Transmission.

For controlling the speed of rotary cement kiln "The Reeves" Transmission is most admirably adapted. It enables you to get a variation of speeds as low as 2 to 1, or as high as 10 to 1; made in sizes from 2 horsepower to 150 horsepower.

For full particulars write The Reeves Pulley Co., Columbus, Indiana, for their illustrated catalog T-160.

Improvements Recently Made in the Western States Cement Plant

Extensive improvements were recently made at the plant of the Western States Portland Cement Company of Independence, Kan., the improvements being those made necessary by increased business. When the Western States plant was built, some 12 years ago, it was considered the last word in cement mill construction. The development of cement manufacturing machinery, however, has been very rapid in recent years, and in order to keep abreast of the times improvements are being made.

Chief among the new installations is a large jaw crusher with an opening 5 feet by 7 feet, weighing 415,000 pounds. It was manufactured by the Worthington Pump & Machinery Company at their Cudahy, Wis., plant. It required five freight cars to transport it. The crusher was placed upon a concrete foundation.

Auxiliary to this crusher is a secondary crusher, in itself of as large capacity as the initial crusher installed at the time the plant was built. It is a mammoth Williams mill, manufactured in St. Louis by the Williams Patent Crusher & Pulverizer Company. A steam shovel has been installed in the quarry for loading the rock which will feed the crusher.

Another item of interest in the way of new equipment is the installation of two oil engines, one 1,000 and one 500 horse-power, to take the place of one of the large steam units which was destroyed in the fire in the power plant of the company, last October.

During the last two months for the first time since the plant was built, powdered coal has been used as fuel in the kilns. The plant in which this powdered coal is prepared for kiln fuel is most interesting. The coal is unloaded from the cars by means of a traveling electric crane and is put through a coal cracker. This reduces the coal to a uniform size after which it is passed through the driers and thoroughly dried. It is then pulverized by three 42-in. Fuller-Lehigh pulverizer mills to the fineness of flour, after which it is conveyed to hoppers over the kilns and blown in through a pipe, igniting immediately upon entering the kilns.

The equipment for the preparation of coal for fuel was installed nearly a year ago, and gives the company the widest possible range in the choice of fuels. At times fuel oil is very desirable; at other times it is prohibitive on account of the sharp fluctuations in price. Gas, too, cannot be depended upon as a year around fuel, as at times it cannot be obtained at all in sufficient quantities to operate the plant.

The vertical electric motors for driving the Fuller-Lehigh pulverizers were furnished by Westinghouse Electric and Mfg. Co., East Pittsburgh, Pa. The jaw crusher and the mammoth Williams mill are also operated by electric motors.

Quarry Accidents

Ten hours after he was injured at the Lehigh Portland Cement plant at Oglesby, Ill., Leslie Gooner, age 17, died in St. Mary's hospital in La Salle. Internal injuries were the cause of his demise.

Goodner with his brother, Everett, who has been working at the plant only two weeks, was stripping in the quarry. While his brother's back was turned a slide of dirt and gravel struck Leslie and buried his body, only the top of his head protruding.

Various Aggregates in Test Concrete Road

City of Philadelphia Constructs Two-Mile Pavement on Oxford Pike to Make Comparison of Latest Theories and Practice

For the purpose of comparing the latest practice and theories of concrete road building, the city of Philadelphia last year completed a test road on Oxford Pike, 11,250 feet in length and 18 feet wide. It is subdivided into five principal sections, each 2,250 feet in length and consisting of a different composition of concrete. Bituminous wearing surfaces about $\frac{1}{4}$ -inch in thickness were placed on one-half of each section. The following details in regard to the construction have been

inuous surfacing materials were applied between August and September.

The five principal sections were subdivided into two sections, each of which, 1,050 feet long, was left covered, while the remaining 1,200 feet was treated with four different bituminous wearing surfaces, the length of each of these treated portions being 300 feet. The materials employed for the wearing surfaces were Tarvia, Ugite, asphalt cut-back and Unionite. The



Schenectady-Glenville Concrete Road, New York.

abstracted from the annual report of William H. Connell, chief engineer of the Philadelphia Bureau of Highways and Street Cleaning.

The construction was commenced on October 5, 1914, and continued until December 4, when, on account of cold weather, it was suspended until March 30, 1915. The concrete was completed on May 18, 1915, sixty-six working days being actually consumed on the work. The lateness of the season in which work was done was not conducive to the best results and is responsible, in a measure, for rather high costs. In all cases when the temperature was below freezing the road was covered with hay and canvas. The bitum-

cross-section of the road was uniform throughout the entire length, being 18 feet in width and having a thickness of $7\frac{1}{4}$ inches at the center, $6\frac{1}{2}$ inches at the quarter points and 5 inches at the sides, the bottom being a flat plane.

Built on Old Macadam

The pavement was built on an old water-bound macadam roadway, which varied from 9 to 18 inches in depth, and which was first spiked and then scarified, after which the macadam was removed to a depth of 5 inches below the finished grade. Then it was thoroughly rolled with a 10-ton roller.

The concrete used was composed of 1 part cement,

2 parts fine aggregate and 3 parts coarse aggregate. The aggregates varied in the different sections. In the first Jersey gravel and whole pebbles were used; in the second, sand and trap rock passing a $1\frac{1}{2}$ -inch ring and retained on a $\frac{1}{4}$ -inch screen; in the third, trap rock grit, and trap rock fulfilling the same requirements as in the second; in the fourth, trap rock grit and limestone of the same size requirements as in the case of the trap rock, and, in the fifth, sand and trap rock grit mixed in equal proportions and trap rock. The mixing was performed in a Packard concrete mixer equipped with a charging device, manufactured by the American Cement Machine Co., Keokuk, Iowa. The surface of the concrete was finished with a template cut to the cross-section of the road and then floated with wooden floats from a movable bridge built to span the concrete. Transverse joints were provided at intervals of 30 feet, and, with the exception of 10 joints which were laid at an angle of 30 degrees, all were laid at right angles to the roadway. Two types were used: prepared bituminous joints and steel protected joints.

The prepared bituminous joints consisted of $\frac{1}{4}$ -inch prepared felt, which extended through the entire thickness of the concrete. In order to secure straight joints, especially on the grades, and to facilitate the placing of the bituminous material, $\frac{1}{4}$ -inch iron plates were placed across the road at each joint with the felt against it, and when the concrete was in place the joint was removed.

The steel-protected joints consisted of plates $2\frac{1}{2}$ inches in depth and $\frac{1}{4}$ inch thick, which were installed with a truss-Con holding device, which was removed as soon as the concrete was placed, $\frac{1}{4}$ -inch prepared felt extending through the entire thickness of the concrete being used between the plates.

After sweeping the surface of the concrete thoroughly, $\frac{1}{5}$ gallon per square yard of Tarvia B was applied with a pressure distributor. After this had thoroughly dried, $\frac{1}{4}$ gallon per square yard of Tarvia A was applied by the same means, at a temperature of 250 degrees and covered with a thin layer of $\frac{1}{2}$ -inch clean trap rock chips in the proportion of 10 pounds per square yard. Three days later a second coat of Tarvia A, $\frac{1}{4}$ gallon to the square yard, was applied with a pressure distributor, and covered with a thin layer of $\frac{1}{2}$ -inch trap rock chips in the proportion of 20 pounds to the square yard.

In the Ugite section, after sweeping the surface of the concrete, $\frac{1}{10}$ to $\frac{1}{8}$ gallon per square yard of Ugite A was applied with a pressure distributor, and, after two hours, covered with a thin layer of $\frac{1}{2}$ -inch clean trap rock chips in the same proportion as the first treatment on the Tarvia section. The following day, $\frac{1}{3}$ to $\frac{3}{10}$ gallon per square yard of Ugite 3 was applied at a temperature of 250 degrees, also by a pressure distributor which, in turn, was covered with a thin layer of $\frac{1}{2}$ -inch clean trap rock chips, 20 pounds per square yard. The following day the second application of Ugite 3, of $\frac{1}{3}$ to $\frac{3}{10}$ gallon per square yard, was applied with a pressure distributor and covered with $\frac{1}{2}$ -inch trap rock chips in the same proportion. This application was rolled lightly with a 5-ton roller.

In the asphalt cut-back treatment a paint coat consisting of 50 per cent naphtha and 50 per cent of asphalt having a penetration of from 55 to 65, and in an amount of $\frac{1}{8}$ gallon per square yard, was applied with a pressure distributor. Twenty-four hours later an application of $\frac{1}{3}$ gallon per square yard of asphalt with a penetration of from 70 to 80, cut-back with from 35 to 40 per cent of naphtha, was applied with a pressure distributor. After two hours this was covered with a layer of trap rock chips graded from $\frac{1}{8}$ to $\frac{1}{2}$ inch, 25 pounds being used to the square yard, and then thoroughly compacted with a 5-ton roller.

The Sack Question in a Nutshell

Getting Full and Prompt Credit on Empty Cement Sacks Requires that Your Sack Man Understands Rules and Their Reasons

Clip This Article and Hand It to Him.

By E. V. Aldridge, Manager, Sack Bureau, Universal Portland Cement Co., Chicago

I. VALUE OF CLOTH SACKS.

1. A carload of sacks is worth more than a carload of cement.
2. Good and repairable cloth sacks are worth 10c each. All other sacks are worthless.
3. Storing large numbers of empty sacks ties up money that earns no dividends. Prompt shipping of sacks brings prompt credit to dealers and sacks to the manufacturer.

II. PARTIES INVOLVED.

1. Railroads handle hundreds of carloads of sacks. They cannot be expected to have the same interest in one bundle as a shipper, especially when their rules are not observed. (See III and IV.)
2. Manufacturer handles millions of sacks a year. He is anxious to give shipper credit with minimum of trouble.
3. Shipper can reduce tedious delays to a minimum by observing rules of railroad and following suggestions of manufacturer.

III. RAILROAD RULES SPECIFY IN PART THAT:

1. Bundles must be tied with three separate wires or ropes. (If rope is used it must be not less than 3-16 inch in diameter.)
2. Bundles must be tagged with linen tags, securely attached by wire.
3. Freight must be prepaid to destination.

Note: Placards for placing in your warehouse contain summary of railroad's rules and manufacturer's recommendations. If your copy is mislaid, write to the manufacturer supplying you for another.

IV. TAGS.

1. Must contain name and address of consignee.
2. Must contain name and address of shipper.
3. Should contain name and address of party to whom credit is to be issued.
4. Should show number of bundles and total number of sacks in shipment.

Note: Filling out blanks completely makes issuing of credit easy and simplifies sorting of thousands of individual shipments received by manufacturer.

V. ROUTING.

1. Shippers should insist that *full routing* to destination be shown in space provided on bill of lading in order to minimize delay in transit.

VI. CREDIT.

1. Bundles must be identified before credit can be issued.
2. Identification card or letterhead inside of bundle insures identification even if tag is lost in rough handling, provided only that bundle reaches destination intact.
3. Failure to send bill of lading delays credit, as shipment often is received by manufacturer before railroad furnishes proper billing.
4. Tags properly filled out enable manufacturer to tell immediately:
 - a. Total number of sacks in shipment.
 - b. Name of shipper.
 - c. Name of party to be credited.

Blasting By Wholesale

A large quantity of rock is quarried from various points in the north part of San Francisco bay, California. This is used for concrete construction, roads, filling for the waterfront, and other purposes, being loaded on skip and hopper barges and towed to various points as desired. For filling in part of the waterfront on the San Francisco side of the bay, and constructing part of the new two-mile mole for the Key Route electric train system on the Oakland side, the Daniel Contracting Co. is supplying about 1,000,000 tons of rock. This is excavated at the firm's quarry at McNear's point, about an hour by water from the city. Here is a fully equipped plant consisting of three steam-shovels, each capable of handling 1,000 to 1,300 cu. yd. of rock in 10 hours, a railroad system with light locomotives and western side-dump cars, and electric dumping apparatus which can fill a skip

grooved boards and connected in straight series. The charges were well tamped with fine and large rock, and the adit filled to the portal. Laying the powder and tamping took about four days. Each section was charged with powder as follows:

Load.	No. 2 powder, pounds.	No. 4 powder, pounds.	Total pounds.
1	2,250	.....	2,250
2	2,300	.....	2,300
3	2,500	.....	2,500
4 .....	.....	2,250	2,250
5 .....	.....	2,250	2,250
6 .....	.....	1,900	1,900
7 .....	.....	1,900	1,900
8	450	1,700	2,150
Total	7,500	10,000	17,500

To help the main blast by cutting away the foot of



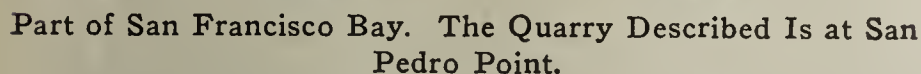
The Blast at the Moment of Disruption. Enlarged from a Moving Picture Film. Rocks Can Be Seen in the Air.

barge of 250-ton capacity in about an hour. Hopper barges carry up to 900 tons each, and may be filled at a greater proportionate rate.

In order to have plenty of rock for the shovels, large quantities of material are broken at the two faces being worked. One is a brown and the other a blue metamorphic sandstone, the latter being the hardest. On April 11 a large blast was made at the brown face, which kept the shovels supplied for over two months. An adit was driven into the hill 95 ft., from which cross-cuts were driven 70 ft. each way. These were only large enough to enable a machine-drill to be worked, and to wheel out the rock broken. The cross-cuts were divided into four sections each, and were charged with du Pont powder. This is received in 12.5-lb. bags, with 4 bags to a 50-lb. case, and is special powder for such large blasts. Three No. 7 electric exploders were inserted in each charge, making 24 in all. Leads to convey the electric current for exploding consisted of No. 14 insulated wire, laid in 2 by 4-in.

the hill, so as to allow the broken rock to slip down, eight 22-ft. holes were bored at equal distances by a machine with 1¼-in. drills. These "toe-blasts" were fired first, and so loosened the bottom. In setting off the large charge, a 220-volt, 110-ampere electric current was switched on to the leads. At the moment of disruption, as shown by the halftone, the whole hill was lifted out several feet, fell back, and then the broken rock started to roll down. There was only a dull thud heard, more noise being caused by rolling of rocks than the actual explosion. In the plan will be seen the old summit of the hill and new line of fracture, in one place 61 ft. apart. The blast was an excellent one, and a total of 166,250 tons of rock, well broken up and requiring no secondary blasting, has since been moved by the steam-shovels, and dumped into San Francisco bay. Each pound of powder broke 9.5 tons of rock.

In wholesale mining, where the conditions are similar, this system of blasting, known as the "coyote," should be satisfactory.



And every road built now will be an asset of incalculable value when peace is restored and all the energies of the nation can again be turned to industrial and commercial development and human progress.

There's a piece of printed matter that just hits the spot, no matter what the call may be. These booklets mean results—each is carefully compiled, accurate, attractive. Full description of uses and directions for use cover every possible case.

For local newspaper advertising there's a full line of electros, of course. Tell us what you want—we'll get it for you. Address the Sandusky Cement Company, Dept. T-5, Cleveland, Ohio.

The Texas Portland Cement Company has voted a five per cent bonus covering salaries for the last three months, to employes at Dallas and Houston. Three hundred persons at the two plants are affected.

Cement Tile Manufacturers Busy

Large and Small Plants Behind on Orders. The War Has Made Bigger Crops a National Necessity. The Farmer Is Utilizing Every Factor That Will Produce Them and Finds None More Vital Than the Proper Drainage of His Land

Reports which Cement and Engineering News has received from cement tile manufacturers throughout the country indicate that many are having an exceptional demand for cement drain tile. This is shown even more decidedly by supplies ordered by these manufacturers for repair parts, new machines, etc., from the manufacturers of cement tile machines.

The demand of the country for greater crops is having its effect upon the farmer; he must and is utilizing every factor to obtain them. Certainly none has proved more important than proper farm drainage. It seems reasonable that this is the explanation for the very good demand for tile some manufacturers are having.

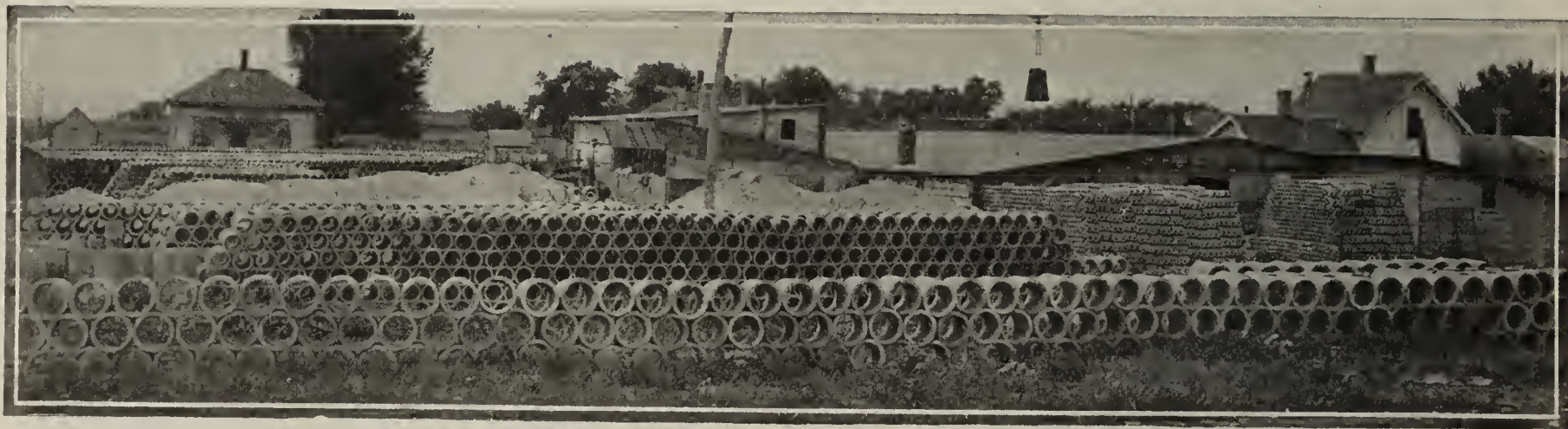
It is, of course, as usual the progressive ones who are taking full advantage of these conditions and many of them are operating full blast. To do the greatest good for the cement tile industry and the farmer all

Reflect a moment and all of this is logical and the reasons easily understood.

War has made bigger crops a national—yes international necessity. The farmer must and is utilizing every factor that will produce them and finds none more vital than the proper drainage of his land.

Those farmers who have long realized its importance and yet delayed doing, are already among the most active buyers. Those who find themselves short of money to carry on the work, have found new and easy means of obtaining it placed at their command. All in all the farmer is left no excuse for not doing his utmost to obtain maximum production. Will the cement tile manufacturers fail to supply their need which now is the need of our country?

Clay tile in the large is poorer in quality and higher in price because of coal and fuel costs. Deliveries of clay tile in many localities which are supplied by a



Demand for All Sizes of Cement Drain Tile at Dallas Center, Iowa.

plants should be active in pushing the business as they never have before. We believe this is the cement tile manufacturer's golden opportunity.

"We have just ordered another cement tile machine. Our customers are hollering their heads off for tile," writes W. S. Barney, of Adair, Iowa, who started in the tile business a year or two ago and found his demand larger than his capacity.

"We are for the first time today putting on a night shift and intend to run the machine steady day and night and may put in another machine," writes the Saffert-Gugisberg Cement Tile Co., New Ulm, Minn.

A beginner, A. J. Bowen, Moravia, N. Y., finds he "cannot get any tile made ahead. They go as fast as we make them. I sold a carload today." And an old-timer, the Redmon Cement Tile and Construction Co., of Redmon, Ill., writes they are "having such a demand for tile it has almost cleaned up the yard."

The Elsberry Concrete Block & Tile Co., of Elsberry, Missouri, with their stock cleaned out, writes: "We are today about 8,000 tile behind on orders and more orders coming most every day. Am selling more tile than I can possibly make and will want to buy a new machine."

These are just a few examples of the reports of cement tile manufacturers the country over. Hundreds of them are operating at top speed, many with greatly increased facilities and then unable to meet their demand.

centrally located plant are almost impossible because of traffic conditions.

To be sure, cement has advanced slightly, and possibly sand and gravel, but compared to the increased margin of profit allowed, the cement tile manufacturer today has a larger net profit than he ever had before.

Concrete workers, this is your golden opportunity to make big money on a demand for tile already created and constantly growing larger. Not only that: In building a permanent business for yourself, in making this big profit you are also doing your utmost to supply the demand for tile which is not now supplied, rendering an actual service to the farmer, and now, in our time of need, to our country as well.

If you are a manufacturer of concrete products, a lumber or building material dealer or contractor, your facilities and your experience in concrete work make it easy for you to start the tile business at a lower cost and more quickly make it highly profitable. Your opportunity is that much greater. Anyway, the manufacture and sale of tile is an integral part of your business because you deal with those—the farmers—who need them now—need them as they never have before.

Rocks falling in the quarry of the Phoenix Cement Company at Nazareth, Pa., struck Dominick Vitterbo, aged 41, and broke his right arm in two places.

Your Choice of GOODRICH BELTS

for the cement or brick and clay products
plant automatically clinches a bargain in
your favor with all its big advantages.

"LONGLIFE" Conveyor Belts and "COMMANDER" Transmission Belts

are natural leaders in their respective fields.

They embody a half century of accumulated belt building
wisdom and experience.

They are super-durable, consequently cost less in the long
run than the big competitive majority—leather or rubber.

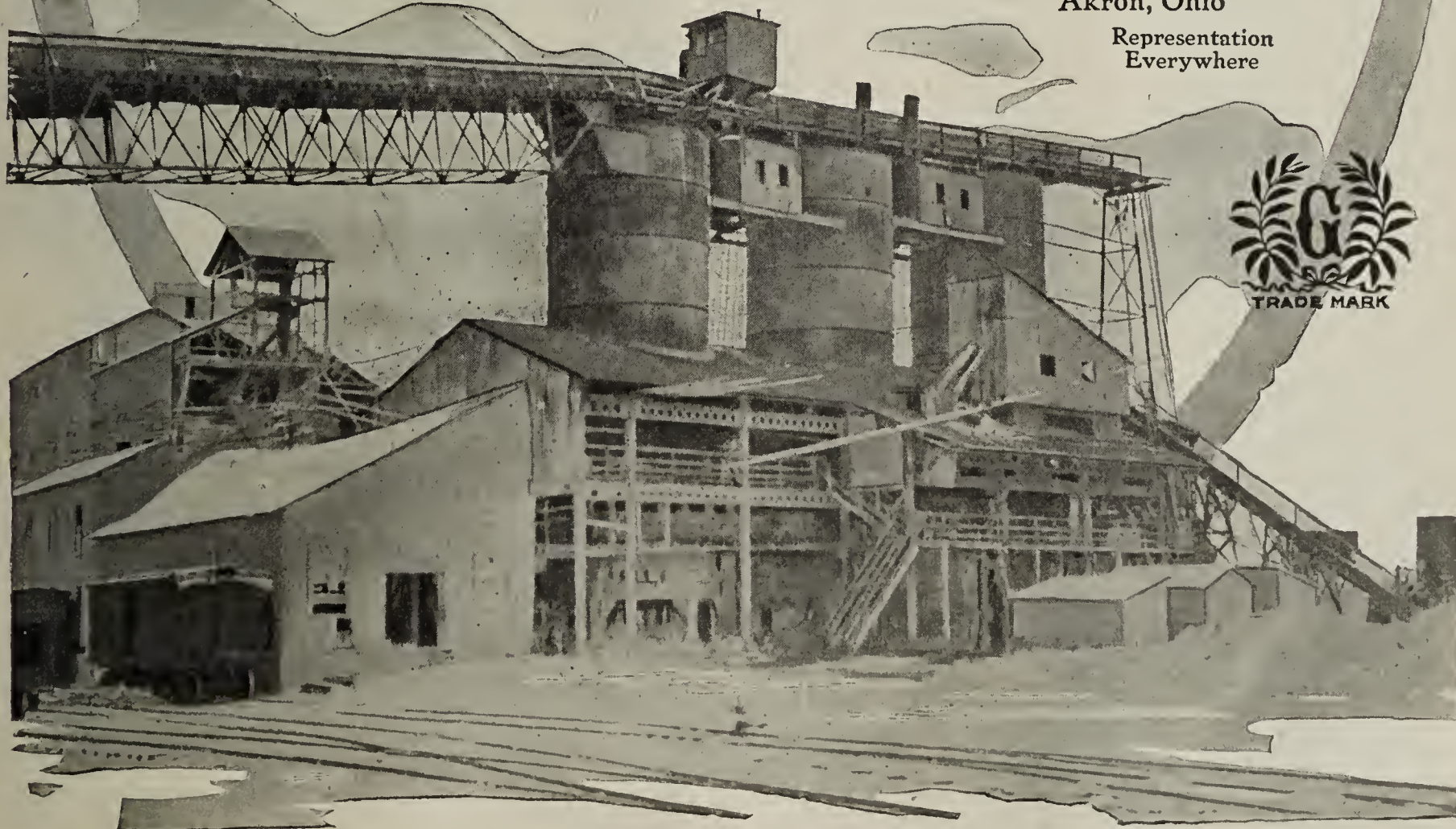
Buy them, use them, watch them—and convince yourself.

THE B.F. GOODRICH COMPANY

Makers of the Celebrated Goodrich Automobile Tires—"Best in the Long Run"

Akron, Ohio

Representation
Everywhere



Concrete Pavement

Spokane county commissioners, Spokane, Wash., have awarded the contract for paving $4\frac{1}{3}$ miles of the Apple Way, east from Dishman station, to the C. M. Payne Contracting Company, on a bid of \$56,270 for one-course concrete.

This action by the county commissioners signalizes a distinct change in paving matters. It is the first instance of giving a contract on a one-course concrete basis as against all other forms of paving. The action was taken following a trip of the commissioners and several business men to coast cities where they made a study of the various types of paving in use upon the highways.

The commissioners and business men came back unanimously of the opinion that concrete was the best pavement, everything considered, for the roads of this section. The initial cost, maintenance and appearance were given careful consideration.

The trip to the coast and the investigation of concrete was made at the instigation of the Spokane Chamber of Commerce, which paid all expenses of the trip. The action by this commercial body came as the result of the presentation by representatives of cement factories of facts and figures on permanent road building. The cement manufacturers presented a mass of data and then offered to pay the expenses of Chamber of Commerce representatives on a trip to the coast to investigate conditions. The Chamber of Commerce trustees, however, felt that the matter was of sufficient public interest to deserve the pre-payment of all expenses. Hence the trip and its result.

Large Contract for Cement Tile

The Jefferson Cement Products Company, Jefferson, Iowa, was awarded a contract for tile of various sizes upon the big Greene-Webster drainage project in north Greene County, Iowa, known as 110-221. The award did not include all of the tile to be used upon the drain, but only such part as the contractors will be able to use during the current season, or about 13 miles of tile of sizes from 46 inch dimension down to the smaller kinds. The award yesterday totalled in amount \$35,859.60. Three bids were filed, all of cement tile, the Cement Products Company, Sac City, Iowa, offering to fill the contract at \$36,313 and the McHose Sand & Tile Company, Boone, Iowa, offering it at \$38,090. As we understand it this is only about one-third of the total amount necessary to complete the project.

Nebraska Cement Plant Absorbed by Denver Company

Negotiations which have been pending for several months have been concluded by which the Cement Securities Company, Denver, Colorado, has come into possession of an important plant which is most strategically located and which will give the Colorado concern a large share of business in Nebraska and contiguous territory. The plant is located at Superior, Neb., on the main line of the Burlington railroad, 398 miles from Denver.

The factory is of three kilns with a capacity of 1,500 barrels of cement a day. It was built several years ago by persons who were not familiar with the business, and two years ago failed. The property was sold some time ago under foreclosure to a committee representing the bonds, and it was from this committee that the Cement Securities Company obtained the plant. A new company, known as the Nebraska Portland Cement Company, has been formed and has taken over the assets of the failed concern, and in this

new corporation the Cement Securities Company will hold a controlling interest and will have charge of operations.

Charles Boettcher, president of the Cement Securities Company, Denver, Colorado, is the president and treasurer of the new company; E. E. Bruce of Omaha is vice president, and R. D. Morse is secretary and general manager.

Already the new management has begun the work of rehabilitating the plant and shipments of cement will be begun not later than July 15. The process will be changed from the dry to the wet method and large stock houses are to be erected to take care of the storage.

A Half Yard Mixer Paving a 10-Foot Alley

The advantages of having a mixer that is compactly designed and easily handled are clearly illustrated in the photograph shown herewith. The mixer illustrated is the Ideal Cincinnatus No. 14 Batch Mixer, having a capacity of 14 cu. ft. loose material.

Peter Praechter, a contractor of Newport, Ky., purchased this half-yard mixer for street paving, but



Ideal Cincinnatus Batch Mixer Paving Alley
when he got the contract for paving a number of alleys, he did not have to buy a smaller mixer especially for this work, as he was able to use the large mixer owing to its compact design and convenient control.

The alley that this mixer is being used on, is only 10 feet wide, yet the mixer was easily handled, and placed this paving at the rate of about 600 lineal feet daily, which is a very good record considering the difficulties the contractor had in getting his material to the mixer on account of cramped quarters.

The extreme width of the mixer shown above is only 8 feet which allowed a clearance of one foot on each side of the mixer.

While this is the same equipment that we recommend for the largest street paving jobs, writes the Ideal Concrete Machinery Co., 1353 Monmouth Ave., Cincinnati, Ohio, it handled this small alley contract very nicely and illustrated the advantage of having a mixer which is adapted to all kinds of paving work.

RIGHT ABOUT, FACE!

Turn away from the "odd jobs" methods of making a scant living. Build concrete water tanks, grain storage, coal pockets and silos. Make big profits. Let the other fellows quarrel over the pesky little concrete jobs that are barely worth your time. Have a business worth while

The POLK SYSTEM of circular monolithic concrete construction maintains with ease its reputation of being by far the best. No scaffolding, no strain on "green walls," no costly delays. Steady progress, perfect alignment, excellent jobs, pleased customers, more and bigger contracts. That's the POLK SYSTEM.

Any time is a good time to start. NOW is the best time. Full details and carefully worked out business plans free. No obligations on your part.

POLK GENUNG POLK COMPANY

Fort Branch
Indiana

175 W. Jackson Boulevard
CHICAGO

BUCKEYE GALVANIZED SILO ROOFS



Entirely self-supporting. Attachments furnished to fasten to concrete silos. A SILO is not complete without roof. The roof prevents freezing of ensilage to a great extent. GAMBREL and EXTENSION roofs give additional capacity to silo at time of filling. This feature alone warrants the purchase. Prices this year comparatively low because we have steel bought before advances. When stock is gone—prices must be higher.

DO NOT WAIT. Write us for prices. State diameter of silo and thickness of wall. Shipments from Kansas City and London, Ohio.

The Pierce Company

1100 Waldheim Bldg.,

Kansas City, Mo.

CORRECT SYSTEM SILOS

Caldwell Silos meet every demand

WHY the constant re-orders from farmers for Caldwell Stave Silos throughout the country?

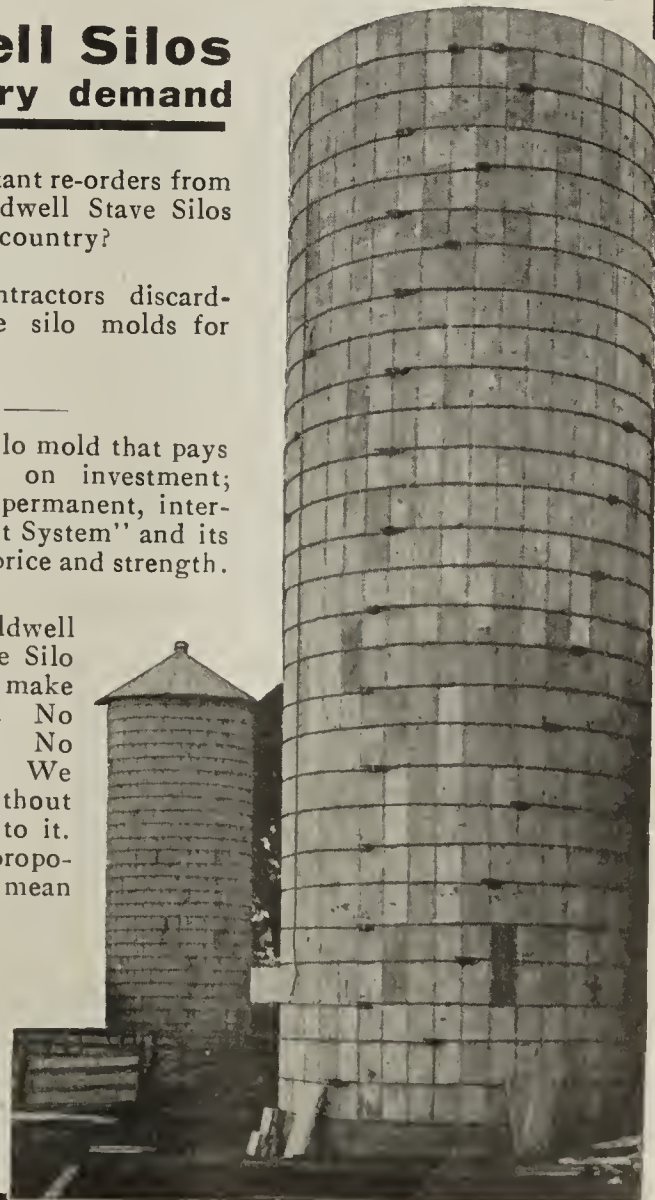
WHY are contractors discarding other stave silo molds for Caldwell's?

BECAUSE it's —

the only stave silo mold that pays large dividends on investment; because of its permanent, interlocking "Correct System" and its simplicity, low price and strength.

Buy a set of Caldwell molds and make Silo Staves as you make building blocks. No royalty to pay. No territory to buy. We sell the outfit without strings attached to it. This is a good proposition and it will mean money to you.

Co-operative
Concrete
Construction Co.
OSKALOOSA, IOWA



Colonel William Cooper Proctor, who is alone financially interested in the improvement, feels confident that although the proposition is more or less a philanthropic one it will prove a paying investment. The rental charge will probably be \$1.10 per room per week, this to include heat from a modern vapor system. The apartments vary in size from one to four rooms. The location is very close to several crowded industrial centers and within fifteen to twenty minutes' walk of the heart of the city. This location, in such a crowded district, while particularly convenient for the workers, necessitates extreme compactness of the apartments.

The ingenious way that they are planned is further shown by the accompanying floor plan. This shows the arrangement for all but the ground floor. On this floor there are but nine apartments instead of the eleven shown. In place of the two apartments there are public baths and showers, and an office for the superintendent of the building. Besides the modern heating system in each apartment there is a gas stove and other necessary conveniences. Screens are supplied for all windows. The children throughout each tenement have the advantage of a well equipped playground and nursery on the roof.

Drinking Water System

At the Plant of the Atlas Portland Cement Company, of Hannibal, Missouri

By A. G. Croll, General Superintendent, Atlas Portland Cement Co.

The Atlas Portland Cement Company have recently installed at their plant No. 6 at Hannibal, Missouri, a refrigerating plant and drinking-water cooling system of more than ordinary interest, owing to the adoption of a system of water purification by use of the ultra-violet ray.

River water is filtered, refrigerated, sterilized, and then circulated through 12,000 feet of 1-inch galvanized pipe to thirty-five sanitary drinking fountains distributed conveniently throughout the plant. The 12,000 feet of pipe is broken up into loops through which the refrigerated water is pumped, the longest of these loops containing about 5,000 feet of pipe. Most of the pipe is laid three feet under the ground, with no other insulation than the clay, the piping above the ground being covered with a cork lagging.

1,500 Gallons an Hour

Fifteen hundred gallons of water are circulated per hour, leaving the pump at an average temperature of 40 deg. F. and returning to the cooling tank at temperatures varying between 50 deg. F. and 55 deg. F.; thus, a fairly uniform temperature is obtained at the fountains, varying between 40 deg and 50 deg. F., depending on their location in the several loops.

The refrigerating plant consists of a 7½x7½" two-cylinder, vertical, single-acting, enclosed, self-oiling, twelve-ton York Ammonia Compressor, driven by a variable-speed 20-h. p. motor and a Shipley double-pipe, flooded condenser. The cooling tank contains 1,200 feet of 1¼" pipe in expansion coils. In addition to the refrigeration of the drinking water, this plant freezes 600 pounds of ice daily for use around the plant.

Sterilized by Violet Rays

The sterilization of the water is one of the unique features of the installation. This apparatus, known as an R. U. V. sterilizer, utilizes the ultra-violet ray as produced by a special mercury vapor lamp sending its rays into the water through a quartz tube. These ultra-violet rays, utilized in this manner, have the power to destroy all germ life in the water without affecting the water in any way or changing its natural constituents.

This new drinking-water system has not only reduced the expense and trouble connected with supplying the workmen with water and ice in barrels, but has been a big step along the line of welfare work, giving employes the benefit of a drinking water absolutely pure and cold.

New Cement Mill in Iowa Starts Making Cement

The Fort Dodge Portland Cement Corporation have started grinding "clinker" at its Gilmore City plant.

It has been seven years since the process of getting this plant to the producing stage was started at Gilmore City, Iowa. The promoters were ultra conservative and would not move faster than they had enlisted capital in the enterprise. For several years they have brought in a considerable revenue from crushed rock which was sold for ballast and concrete construction work. Now they reach their ultimate aim by making cement.

The present mill is a first "unit" and will have a capacity of 1,500 barrels per twenty-four hours. It is expected that before long an order for a second unit of equal capacity will be placed.

There is an endless amount of limestone rock at the site of the mill. Analysis has shown it is of the right test for good cement.

The mill is on the Ruthven branch of the M. & St. L. It is expected that the Chicago and Northwestern will furnish a spur from near Rolfe, which is four miles away.

S. L. Nicholson Promoted

Samuel Lindsey Nicholson, who has been Sales Manager of the Westinghouse Electric & Mfg. Company since 1909, has been promoted to the position of Assistant to Vice-President, with headquarters at East Pittsburgh.

Mr. Nicholson is unusually well known throughout the electrical profession because of his varied activities bringing him in contact with its numerous branches.

He was born in Philadelphia, received his education in the William Penn Charter School of that city, and began his business career as an apprentice with the Belmont Iron Works in 1887.

Mr. H. D. Shute, whose election as Vice-President of the W. E. & M. Co., was recently announced, will have executive charge of the company's commercial organization, both domestic and export, succeeding Vice-President L. A. Osborne, whose headquarters have been transferred to New York.

SYNSTONE PRODUCTS

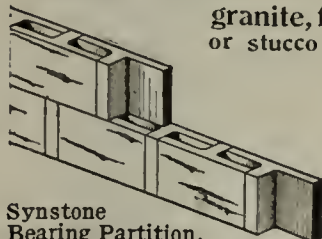


SYNSTONE SINGLE WALL, 9 to 13 inches

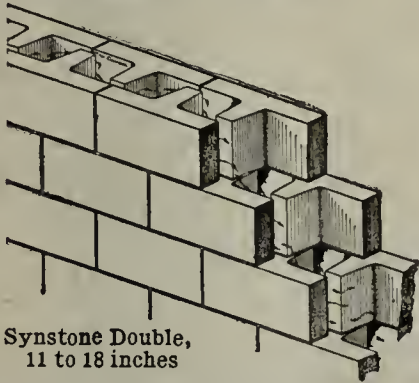
The Last Word in CONCRETE Construction

Costs Less Than Any Other Practical Wall Construction

Wet process, making real Concrete walls, impervious to heat, cold and moisture, fireproof and everlasting. Hollow Concrete Walls, stronger than brick, faced with beautiful natural material—crushed granite, feldspar, marble or sandstone, with all the sparkle and life of natural stone. Brick or stucco facings if desired. A wet, soggy mixture, 1 cement, 2½ sand and small gravel, 4 parts or 1" stone or gravel, producing stone withstanding 3000 lbs. pressure per sq. inch and 1700 degrees heat for one hour without injury. Complete machinery making all walls and all shapes and sizes of blocks required for them, by simply hooking on another core. Every block perfect with true edges. Unskilled labor, one, two or three men, capacity 50 blocks or 100 sq. feet per hour.

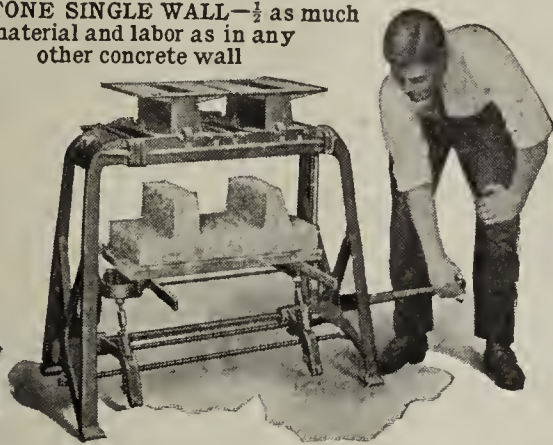


Synstone Bearing Partition, 3 to 12 inches



Synstone Double, 11 to 18 inches

SYNSTONE SINGLE WALL—½ as much material and labor as in any other concrete wall



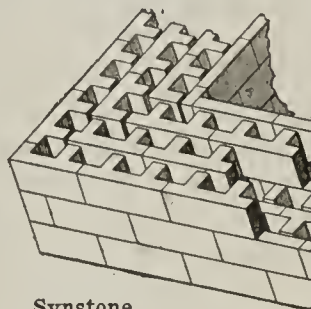
SYNSTONE MACHINE

Send for catalog.

Equip Yourself to Meet any Competition Offered

The Ferguson Synstone Company

805
17th St., Denver,
Colorado, U.S.A.



Synstone Wide Wall, 19 to 60 inches



Synstone Brick Veneer Wall, 13 to 17 inches

The Multiplex Double Stripper Block Machine makes two Hollow Plain or Rock Faced Block of Wet Mixture at ONE OPERATION



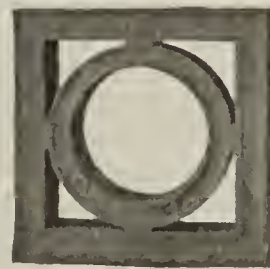
Here is a machine that cuts down the cost of making your building block. In making plain faced block the machine handles a wet mixture and stripping the block out it trowels the sides. The wet mixture compacted under pressure from *both top and bottom*, produces a strong waterproof block which is easily cured. A 150-lb. man on the end of the lever will exert a 40-ton pressure on the block. Two men will make from 700 to 800 blocks per day on this machine.

Write for our latest printed matter explaining the operation of this labor-saving machine in detail

Write for catalog No. 10 and mention Cement News
The Multiplex Concrete Machinery Co., Elmore, Ohio

Same Machine Makes Chimney Block

The Multiplex Stripper may be equipped for manufacturing chimney block as well as building block. Note the flue block shown here with the round smoke chamber in the center, the ventilating chambers in the corners and the tongue and groove joints insuring rigid construction. There is money in the manufacture of chimney blocks alone.



Concrete in the Country

How the American Farmer is Solving His Conservation Problem

Conservation is no new problem—it is as old as life itself. It becomes a highly important question to the person or the nation only when the resources scarcely supply the demands. Such is the situation in the United States today. In the early days the removal of the forests was necessary that much grain might be grown. The young Nation had to have money, and as farming was the only means at hand to furnish it, the natural fertility of the fields was reduced. But the money thus supplied was merely a long-time loan on the Bank of Natural Resources. Today the vanishing forests and the failing fertility of the fields bear witness that the loan is now due. Hence the problem of conservation. Strange as it may seem, the farmer is using one material not only to replace lumber but also, in a way, to restore the fertility of his fields—that material is concrete.

The national and state governments and the railroads were the first to make extensive use of concrete. Not only did the beauty and mystery of this new construction naturally appeal to the farmer, but he concluded that the railroads did not use it, in preference to wood, steel and stone, merely to decorate the landscape. He knew too much about railroads. So strongly did the railroads' idea of economy (the dollar argument) appeal to him that the farmer of the West is now building practically everything about the farm of concrete. At first, and quite naturally, land-owners in the rock and gravel regions began using this new form of construction; but, since its cheapness in first cost and value in lasting qualities have become generally known, a wave of enthusiasm for farm structures of concrete has swept the entire country. A gravel pit is now more valuable than many a gold mine.

With little help other than looking and listening, the farmer grasped the idea of a concrete walk, and being a natural inventor and jack-of-all-trades, improved on the method by adding a small curb next to his flower bed to keep the dirt from washing on the white walk. This walk was a blessing to the boy—all the time formerly given to scrubbing and weeding the old brick walk could now be devoted to fishing. The yard walk was extended to the barns and outlying buildings. Wading through seas of mud and resulting tracked-up kitchen floors became a thing of the past. By simply increasing the width of the walk, a cellar floor was provided and the farmer had a dry cellar. This was so clean and so odorless that he considered such a floor fit for that most immaculate of all places—the milk house. Concrete cellar hatchway and steps, safe under the heaviest barrel of vinegar, and water-tight, were made in a manner similar to walks.

Brick work had long been laid up in a mixture of Portland cement and sand. As this kept the water out, the farmer reasoned that it would keep the water in, and he started to build cistern floors, walls and cover of Portland cement concrete at one-third to one-half the cost of the old brick cistern.

After a little more observation, he quit digging deep cistern-pits, with the necessary annoyance of thawing out frozen pumps and carrying water—he built a concrete cistern on top of the ground and made the pumping and carrying of the water a mere matter of turning a faucet in the kitchen and the bath room.

Several years ago corn was so cheap that in some sections it was burned for fuel instead of coal. No consideration was then given to the bushels wasted in

muddy feed lots. If the mud became too deep, the feeding was transferred to the blue grass pasture. To be sure, as the sod wore out, the feeding-place had to be changed; but somebody had advanced the idea that this particular method of feeding was good for the soil. Many farmers had tried wooden feeding floors and had found them a paying proposition as far as the saving of feed was concerned, in the general health of the animal, and in the shortened time of fattening. But two great drawbacks were the rats that infested them and the constant need of repairs. In concrete the thoughtful farmer saw the possibilities of an ideal floor—an easily cleaned, rat-proof, disease-proof surface upon which his hogs, sheep, cattle and poultry might consume the feed even to the smallest particle.

So satisfactory did the feeding floor prove that the same treatment suggested itself as a remedy for the fly-breeding, muddy holes in the earthen floors and the rat-infested wooden floors of the barns. But the careful horseman held up a bit: he was afraid that stamping at the flies, his valuable Percherons, Shires and Morgans might stiffen up their legs. He experimented by placing concrete floors in his open sheds, which were usually too muddy for the stock to lie down in stormy weather, just when the straw stacks afforded no protection and when he needed the sheds most, and found such floors satisfactory.

Today the manure question is one of the most important considerations of the time. The virgin soil of the prairies, of the cleared woodlands and of the broken-up ranges, for a few years produced immense crops of cotton and grain. To build up the decreasing productiveness of the fields the farmer soon learned that barnyard manure was the best thing at hand. The passing of the cattle ranch and the resulting higher price of meats made stock raising very profitable even to the small farmer, especially since feeding floors made it possible for him to return to the soil, in the form of manure, all the fertility which had been removed in the growing of grain. Leaving out the matter of foods, the strength of manure is dependent directly upon its manner of storage. Manure piled on the bare ground or in wooden pens loses one-third to one-half of its fertilizing properties on account of leaching, due to heavy rains and tramping of the stock, and later because of fermentation or "firing" brought about by the lack of sufficient moisture. This fertilizer usually sells at 75 cents to \$1.00 per load.

The farmer of to-day builds a water-tight concrete cistern or pit in which he stores the manure and keeps it as moist as need be. He extended the concrete floors to the dairy barns with the result that they were so clean, so odorless and so sanitary that state inspection is now often insisting and will soon force careless dairymen to put in such floors as a means of protecting the public health from disease germs carried in unclean milk. The drop-gutters carry all the liquids, the richest part of the manure, formerly wasted, to the manure pits. Consequently, one load of manure, thus properly preserved, is easily worth two loads as ordinarily stored. By confining the manure in pits and by paving the barn lot with concrete, the farm has been rid of the chief breeding-place of flies, gnats, mosquitos and disease. Moreover, such an interior court, surrounded by buildings and concrete wind-walls, forms an excellent feed and winter exercise lot.

Government statistics show that the human death-

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North Carolina Water-Power Development One of the
World's Big Undertakings. This Concrete Dam is
220 ft. high, 1300 ft. long, 160 ft. thick at
the base, and 20 ft. at the crest

North Carolina Water-Power Plant

Big construction jobs are now so common that they have ceased to be classed among the world's wonders, but, nevertheless, wonderful they are.

There is now under way in North Carolina a dam and power plant that is one of the greatest construction projects of this kind in the South, or in the world, for the matter of that. See illustration on page 233 of this issue. Some idea of its magnitude is obtained from a published statement at the time the work was started, to the effect that with the exception of contracts for the Panama Canal and the New York subways, the largest single order for concrete ever placed up to that time, in this country, was for this job.

This hydro-electric plant is at the Narrows of the Yadkin River below Whitney, N. C., and it is designed to generate on an average of 45,000 kilowatts.

A contract for building a concrete dam and powerhouse, driving tunnels and grading site for the electrolytic plant was let in 1913 to the Hardaway Contracting Co. of Columbus, Ga., and work was begun shortly thereafter, but, when the war broke out in 1914, work ceased, as French capital then controlled the project. Later the French Company was bought out by the Tallahassee Power Company, a subsidiary of the Aluminum Company in America, and work was resumed in 1916.

This dam is to be 220 ft. high, 1,300 ft. long, 160 ft. thick at the base, and 20 ft. at the crest. It will swing as the arc of a circle of 1,678 ft. radius, and it will form a reservoir of over 5,000 acres in area. The stored water will generate from 20,000 to 70,000 kilowatts, according to the water stage.

The dam is of Cyclopean concrete, with about 33% of the imbedded boulders, which range in size from 15-ton stones down. About half a million cubic yards of concrete will be required.

It is said that the equipment originally installed by the Hardaway Contracting Co. on this work, exclusive of renewals, cost over a million dollars.

All materials entering this work are handled by 25-ton lifting capacity steel guyed derricks, of which there have been fifty in use. They have 115-ft. masts and 100-ft. booms, and are equipped for the most part with $\frac{5}{8}$ -in. and $\frac{3}{4}$ -in. Hercules wire rope for operating lines, and guyed with 1-in. diameter Leschen plow steel rope.

Each of these derricks is supported by six guy ropes, and over sixty-five miles of wire rope was required to hold this battery of derricks in place.

For bringing material within reach of the derricks, a network of railroad tracks has been installed, over which operate 100,000-lb. flat cars drawn by twenty-two locomotives. Two stone quarries near the work site provide the necessary rock, which is transported on the flat cars to two mixing plants, where crushers are located. Cement is delivered by train.

Sand is obtained at a distance of 60 miles and is supplied by rail at the rate of 900 yds. per day.

The power-house is 580 ft. long and 57 ft. wide. It is designed for four units and is to be equipped with vertical shaft turbines direct-connected to alternating current, 13,200-volt, 36-cycle generators of 27,000 horsepower each.

The cost of this dam with the hydro-electric installation and equipment is estimated at \$10,000,000. The construction work for the Hardaway Contracting Co. is in charge of Mr. S. S. Scott, superintendent.

The Hardaway Contracting Co. is an important factor in the development of the South, as this project is only one of many large water-power plants that have been successfully undertaken by this company.

"Adamant Silica" Tube Mill Linings

The Jasper Quarry Company, 204 Lytle building, Sioux City, Iowa, who have recently placed upon the market a very successful adamant silica tube mill lining, writes us as follows:

"We are enclosing herewith a report of the physical test made by the Iowa State Engineering Department, also a copy of the chemical analysis made by the U. S. Department of Agriculture, and copy of a letter from the Cornucopia Mines Company of Cornucopia, Ore., who have now been using our liners over a year in their mills in Cornucopia. They are selecting this liner for two reasons. One is that they have used our liners for a sufficient length of time to know what it will do and second, that their ore is noted for its hardness and abrasiveness, and it is generally known among mining men that they use the cyanide process and all of their grinding is wet, which, of course, wears out the lining much faster than dry grinding. We have a large supply and can furnish stock sizes very promptly.

"One of the interesting facts which I learned while in the copper mines in Montana was that for a mill where a manganese steel lining costs \$1,400 and the white iron lining about \$700, our liners would cost about \$250 for the same sized mill. In a mill where there is any corrosive acids used the metal lining does not last any longer than our lining, and our adamant silica lining, being entirely impervious to the action of acids.

"While there is probably a great many different places where stone fully as hard as ours can be obtained in the United States we have yet to find anything that will compare in toughness. Stone may be very hard and not stand up in a tube mill as the continual jar and pounding of the pebbles or balls in the mill tends to shatter the lining if they are brittle, regardless of how hard they are.

"We are producing a pebble for grinding, running in any size required. You will note in the letter from the Cornucopia Mining Company what they say of the life of our stone when used as pebbles. They thought they had a very hard stone of their own which they had been using as pebbles. You will note in their letter they say ours lasts 15 days as against two days for theirs. When used as pebbles or balls in a mill our stone wears off in a very fine powder and does not fracture and chip off. This is very important from the grinding standpoint so a pebble that fractures and spalls off either spoils the product that is being ground or takes the time grinding the spalls off the pebbles which should be used in grinding the ore or other product.

"We are sending you a small piece of our lining which has been in actual service in a tube mill. You will note it wears very smooth and wears down to a thin section without fracturing.

"If there is any further information which we can give any of your readers we shall be very glad to have them write us."

The Chicago Cement Machinery and Building Equipment Show

The plan to convert the old Cement Show into a Contractors and Builders Show, which will include all building and contracting lines, is meeting with the enthusiastic approval of manufacturers and producers of building materials and equipment. By combining Cement Shows, Road Shows, Clay Shows and Wood Product Shows into one big show, several small and partial successes should be converted into one big success.

Proposed Standard Methods for Measuring Concrete Work

Recommendations of Committee on Measuring Concrete
Appointed by American Concrete Institute.

The following divisions are recognized as separate and distinct items in the construction of concrete work for which separate modes of measurement are necessary:

I. Monolithic Concrete:

- (a) Concrete.
- (b) Forms.
- (c) Reinforcement.
- (d) Surface Finish.

II. Sidewalks.

III. Structural Cast Concrete:

- (a) Concrete.
- (b) Reinforcement.
- (c) Erection.

IV. Cast Concrete Trim and Ornamental Work.

The following general rules shall govern the measurement of the above operations (with the exceptions where specifically noted):

- (a) All work shall be measured net as fixed or placed in the structure.
- (b) In no case shall non-existent material be measured to cover extra labor.
- (c) No allowance shall be made for waste, voids, or cutting.

I. Monolithic Concrete

(a) Concrete.

1. The unit of measure for all concrete shall be the cubic foot.
2. In no case shall the measurement of concrete include the forms.
3. All concrete shall be measured net as placed or poured in the structure.
4. In no case shall an excess measurement of concrete be taken to cover the cost of forms or extra labor in placing.
5. All openings and voids in concrete shall be deducted with the following exceptions:
 - (a) No deduction shall be made for reinforcement, I-beams, bolts, etc., embedded in concrete except where a unit has a sectional area of more than 1 sq. ft.
 - (b) No deduction shall be made for pipes or holes in concrete having a sectional area of less than 1 sq. ft.
 - (c) No deduction shall be made for chamfered, beveled or splayed angles to columns, beams and other work, except where such chamfer, bevel or splay is more than 4 in. wide measured across the diagonal surface.
6. Each class of concrete having a different proportion of cement, sand or aggregate shall be measured and described separately.
7. Concrete in the different members of a structure shall be measured and described separately according to the accessibility, location or purpose of the work.
8. Concrete with large stones and rocks embedded in same (cyclopean masonry) shall be measured and described according to the richness of the mix and the percentage of rock in same.
9. Concrete in stairs shall be measured by the cubic foot and shall include surface finish when the mixture is the same throughout.

(b) Forms.

10. The unit of measure for form work shall be the square foot of actual area of the surface of the concrete in contact with the forms or false work.
11. Forms shall in every case be measured and described separately and in no case shall the measurement of concrete include the forms.
12. No deduction shall be made in measurement of surface of concrete supported by forms, because of forms being taken down and re-used two or three times in the course of construction.
13. The unit price for superficial measurement of forms shall include the cost of struts, posts, bracing, bolts, wire ties, oiling, cleaning, and repairing forms. No measurement to be made of these.
14. No distinction shall be made between wood and metal forms.
15. Forms to different parts of a structure shall be measured and described separately according to the position in the structure, accessibility, purpose and character of the work involved.
16. No allowance shall be made for angle fillets or bevels to beams, columns, etc., but curved moldings shall be measured and described separately as herein-after provided.
17. No deduction in measurement of forms shall be made for openings having an area of less than 25 sq. ft.
18. No deduction shall be made in floor forms for heads of columns of any shape.
19. No deduction shall be made in column and girder forms for ends of girders, cross beams, etc.
20. No allowance shall be made for hand-holes in column forms for clearing out rubbish.
21. The measurement of column forms shall be the girth of the four sides or circumference multiplied by the height from the floor surface to the under side of floor slab above.
22. Forms to octagonal, hexagonal and circular columns shall be measured and described separately from forms to square columns.
23. Caps and bases to columns and other ornamental work shall be measured by number and fully described by overall dimensions.
24. The measurement of beam forms shall be the net length between columns multiplied by the sum of the breadth and twice the depth below the slab, except for beams at edge of floor or around openings, which shall have the thickness of floor added to the sum of the breadth and twice the depth.
25. Wall forms shall be measured for both sides of concrete wall.
26. Allowance shall be made by number for pockets left for future beams.
27. Moldings in form work shall be measured by the lineal foot.
28. Forms to circular work shall always be measured separately from forms to straight work.
29. No measurement or allowance shall be made for construction joints in slabs, beams or arch ribs, to stop the day's concreting.
30. Construction joints or expansion joints to dams and other large masses of concrete shall be measured by the square foot as they occur.

31. Forms to cornices shall be measured by the lineal foot and the girth stated. (The term girth shall be taken to mean the total width of all curved and straight surfaces touched by the forms.) Plain forms to back of cornices to be measured separately.

32. Forms to window sills, copings and similar work shall be measured by the lineal foot.

33. Forms to the upper side of sloping slabs, such as saw-tooth roofs, shall be measured whenever the slope of such slab with the horizontal exceeds an angle of 25 degrees.

34. Forms to the under side of stairs shall be measured by the superficial foot.

(a) Forms to the front edge of the stairs shall be measured by the lineal foot.

(b) Forms to the ends of steps shall be measured by number.

(c) Reinforcement

35. The unit of measure of reinforcement shall be the height in pounds.

36. The weight shall be calculated on the basis of a square rod 1 in. x 1 in. x 12 in., weighing 3.4 lb.

37. Steel rods for reinforcement shall be measured as the net weight placed in the building.

38. Deformed bars shall be measured separately from plain.

39. No allowance shall be made for rolling margin.

40. No allowance shall be made for cutting or waste.

41. No allowance shall be made for wire ties, spacers, etc.

42. No separation shall be made according to accessibility, location and purpose of reinforcement except in special cases.

43. In measuring reinforcement the rods shall be measured by the lineal foot as laid. All laps shall be allowed for.

44. The rods of each different size shall be measured and described separately.

45. Bent bars shall be measured separately from straight bars.

46. Pipe, sleeves, turnbuckles, clamps, threaded ends, nuts, and other forms of mechanical bond shall be measured separately by number and size and allowed for in addition.

47. Wire cloth, expanded metal and other steel fabrics sold in sheets or rolls shall be measured and described by the square foot. The size of mesh and weight per square foot of steel in tension shall be stated. No allowance shall be made for waste, cutting, etc., but all laps shall be measured and allowed for.

(d) Surface Finish.

48. The unit of measure for finish of concrete surfaces shall be the square foot. Finish shall always be measured and described separately.

49. No measurement or allowance shall be made for going over concrete work after removal of forms and patching up voids and stone pockets, removing fins, etc.

50. Granolithic finish shall be measured by the square foot and shall include all labor and materials for the thickness specified.

51. Finish laid integral with the slab shall be measured separately from finish laid after the slab has set.

52. No allowance shall be made for protection of finish with sawdust, sand or tenting.

53. Grooved surfaces, gutters, curbing, etc., shall be measured separately from plain granolithic and shall be measured by the square foot or lineal foot as the case may require.

54. The following shall be measured by the square foot:

Cement wash. (State how many coats.)

Rubbing with carborundum.

Scrubbing with wire brushes.

Tooling.

Picking.

Plastering.

Etc.

II. Sidewalks and Pavements

55. Sidewalks and pavements shall be measured by the square foot, the thickness to be stated in description.

56. Finish lining in squares and cinder or stone foundations shall not be separately measured but shall be described.

57. Curbs and curb and gutter work shall be measured by the lineal foot and separated according to character and size, and shall include foundations, forms, finish and cost of special tools if any.

58. In measuring curbs the full height and width or thickness of same shall be taken to extreme edge.

59. Circular corners to curbs and gutters shall be measured separately by number, stating radius and length measured on the curve.

60. Vault lights shall be measured by the square foot, the size and type of glass, forms, steel and finish to be described but not measured separately. Beams under vault lights shall be measured by the lineal foot. In measuring vault lights the measurement shall go at least 4 in. beyond the outside line of the glass in each direction.

III. Structural Cast Concrete

(a) Concrete.

61. The term structural cast concrete is taken to include unit construction by the various systems.

62. The unit of measurement for structural cast concrete shall be the cubic foot, and shall be measured net as provided for monolithic concrete.

63. The various members shall be measured on the ground before erection.

64. No measurement shall be taken of forms.

(b) Reinforcement.

65. Reinforcement shall be measured separately as provided in Paragraphs 35 to 57, inclusive.

(c) Erection.

66. The unit of measure for the erection of structural concrete shall be the weight of the finished member in pounds.

67. In measuring the erection of structural cast concrete having a crushed stone or gravel aggregate, the concrete shall be assumed to weigh 150 lbs. per cubic foot.

68. No measurement shall be taken of the grouting in structural cast concrete. It shall be deemed to be covered in the price of erection.

IV. Cast Concrete Trim and Ornamental Work

69. Cast concrete trim shall be measured by the cubic foot, but the measurement shall be the smallest rectangular solid that will contain the piece measured and not its actual content.

70. No allowance shall be made for forms.

71. No allowance shall be made for reinforcement in trim and ornamental work.

72. No allowance shall be made for surface finish in trim and ornamental work.

73. Circular work shall be measured separately from other work.

74. Mitre blocks and end blocks for cornices, etc., shall be measured separately from straight molded work.

75. Vases, seats, pedestals, balusters and other similar items shall be measured by number and description with overall dimensions.

Reinforced Concrete Ships—Why Not?

Concrete Barges in Successful Use for Years Show That Similar Methods Might Be Used for Ship Building

The problem that confronts our country of increasing the merchant marine requires the consideration of every possible method or material of construction. Several prominent engineers have suggested reinforced concrete.

A San Francisco paper mentioned in a recent issue the interesting fact that a local firm of engineers was designing a ship with a length of 330 feet, a beam of 44 feet and a depth of 31 feet, with a capacity of 4,500 tons—to be built of reinforced concrete. This is not something new—a concrete schooner was employed for some years in the north Atlantic coasting trade, having been constructed in about 1898. The London Times mentions a small boat of reinforced concrete

and are 8 feet deep. They are very thoroughly reinforced.

Vessels which are more like ships than barges have been built of reinforced concrete in Norway. A report from the American Consul General at Christiania describes a plant at Moss, Norway, where vessels of 3,000 tons displacement are being constructed. The following quotations from the report indicate the extent of the work under way at that time:

"The inventor of this new style of vessel is said to be M. Nicolai Fougner, an engineer, who claims to be able to construct a ship of any size demanded. He is now building a lighter for a mining company at Sydvaranger for the oversea export of iron ore and the import of coal. The vessel, having a displacement of 3,000 tons, is to be ready before the end of the current year. It is stated that these concrete ships can be sailed or engined like other vessels, and experts consider that a new epoch in shipbuilding has arrived.

"The ship, which arrived in Christiania last month, resembles a large barge, and is constructed entirely of



built by a Frenchman in 1849 and still in service after a test of 68 years.

The concrete ship is only a further development of the concrete barge and such craft have been in successful use of years. Concrete lighters have been used for the past six years on Chesapeake Bay, supplying coal and water to dredges, carrying loads of sand and gravel, etc., and the accompanying illustration of a 500-ton lighter on the ways just before launching is typical of their appearance. With such a craft there is no necessity for caulking or painting, the upkeep is small and there is no danger of decay. Barnacles will not collect on a concrete hull.

A concrete barge has been in service on the Welland Canal since 1910 and has seen very hard usage. It has a length of 80 feet, a beam of 24 feet and is 7 feet deep. It is interesting that the walls which were constructed between forms are $2\frac{1}{2}$ inches thick, reinforced with steel rods, yet the barge is used for carrying loads of stone, etc., with conspicuous success.

Since 1910 reinforced concrete barges have been built for use on the various sections of the Panama Canal and their experience has enabled the engineers to develop a very efficient type of vessel. Recently concrete pontoons were constructed for service as landing stages for boats up to 65 feet in length. These pontoons have a length of 120 feet, a beam of 28 feet

concrete with the exception of the ribs, which are of steel. This new method of constructing ships has attracted much attention. The Swedish Minister of Marine, M. Brostrom, one of Sweden's largest ship-owners, immediately ordered a lighter of some thousand tons displacement, and he was present when the craft was launched at Moss. He was accompanied by four experts, all of whom expressed much satisfaction at the result.

Two other lighters are now on the stocks, and a large slip for a 4,000-ton craft is nearly completed. More than 200 men are now working in the new yards, and five lighters have been contracted for in addition to the one completed and the two on the slips."

In view of such examples proving the usefulness of concrete vessels of this character, it would seem wise to consider concrete in the construction of ships which are to increase our merchant marine to the proportions demanded by the present requirements. If sea-going barges were to be constructed, or smaller craft suitable for lake traffic, this would release for other purposes many ships now in use in this capacity. The presence of the necessary materials for a concrete vessel at so many convenient locations would make it possible to provide a large tonnage, and progress in construction would be faster than with ships of steel or even wood.

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JOHN F. WALDRON

Advertising Manager

CHICAGO, SEPTEMBER, 1917

Dynamite is More Useful Than Ornamental

Road builders have known for years that dynamite is necessary for making rock cuts and blasting rock ledges for crushers, but many of them today do not consider it worth while to have any dynamite around, unless they are working in solid rock. However, it is the purpose of this article to point out a few other places where dynamite may be used to advantage by road builders.

In going through a cut in light soil it helps in loosening up the dirt if charges of a half cartridge of 20 per cent Red Cross are fired in holes to the required depth, five or six feet apart, each way. Then the scrapers can handle it with ease, doing away with a great amount of hand picking and shovelling. In a hard clay soil, charges of one to two cartridges of 20 per cent dynamite may be used in holes four to six feet deep, and spaced about six feet apart, and will be found satisfactory for loosening the soil for the scrapers.

Out-crops of rock are frequently met with in road construction, and, of course, require to be drilled either by hand or machine drill for the economical use of explosives. Where it is not possible to drill these out-crops, they may sometimes be mudcapped but this takes several times as much dynamite to do the work under most favorable conditions as compared with that required in a drill hole, and, frequently, is absolutely impractical. Boulders may sometimes be blasted by firing charges in holes driven beneath them with a bar, or they may be drilled and fired, or, if very hard and brittle, it is most economical to mudcap them.

Stumps may be taken out economically and quickly by firing charges of dynamite under them, placed far enough below the surface of the ground so that the crater produced will include the greatest proportion of the roots. Put the charge in the earth under the stump, rather than in the wood itself, except that with stumps having large tap roots; the explosive should be placed either directly in the tap root or on either side of it and about two feet beneath the surface of the ground. Do not try to mudcap the stump, or to get the explosive down into the center of a rotten stump.

This splits and spreads it apart; but makes the final extraction of the roots a difficult problem.

Ditching is frequently necessary and may be done in two ways, depending on the character of the soil. In a dry, sandy soil, single cartridges, 1¼x8 inches of dynamite are placed in holes two to three feet apart and two to two and one-half feet deep, with an electric blasting cap in each hole and the entire line connected up in a series and fired with a blasting machine. In very wet, heavy soil or swampy muck, the ditch may be made by firing charges of one cartridge of 50 per cent straight dynamite in each hole spaced 18 inches apart and two to two and one-half feet deep. In this case, it is not necessary to use an electric blasting cap for each hole. One extra cartridge placed in a hole near the center of the line of holes and fired by either an electric blasting cap or a blasting cap will detonate the entire line by influence. Ditches have been dug over a thousand feet long by this method. A hand dug ditch usually costs just about twice as much as a dynamited ditch.

Sink-holes, mud-holes, bog and miry spots in low lying portions of country roads are often effectually and permanently drained by firing charges of dynamite in holes driven into the impervious stratum of soil, usually clay or hard-pan which forms the basin and prevents the water from running down into the earth. These charges should be fired fifteen or twenty feet apart each way, the depth depending upon the nature of the soil. Wet spots in roads have been permanently cured at very little expense by this method.

Dynamite is one of the handiest and most reliable helps the road builder can have in his equipment. It can be used for felling trees, making post holes for fences or planting trees, and for digging and loosening up the soil for telegraph and telephone pole holes.

Road builders as yet have not exhausted the possibilities of its usefulness, but those who carried it in stock and used it intelligently would no more dispense with it in any operation than they would with their equipment of picks and shovels.

Munition Manufacturers Hustling

Among the recent contracts of the Aberthaw Construction Co. of Boston are two which show how the munition manufacturers are hustling to keep pace with government orders.

The Colt's Arms Co. of Hartford, Conn., has within a year contracted with this company for increased manufacturing space amounting to over 273,000 square feet. Approximately half of this amount is included in a four-story building completed about the first of this year. Just as war was declared the company was again forced to expand to take care of additional government orders. The construction company is now working on the new building—a one-story structure 490 feet long by 260 feet wide—and expects to complete it ready for manufacturing by the middle of this month (July), just three months from the receipt of the order to start. The cost of this new building will be around \$300,000.

In addition to this, the Aberthaw Company has just closed a contract with the well-known revolver manufacturers, Smith & Wesson, in Springfield, Mass. This building is a five-story structure and will add over 60,000 square feet of manufacturing space to the company's present big plant.

Belt Buyers' Guide

Belt Buyers' Guide is the title of the Chas. A. Schieren Co.'s latest publication describing and illustrating their well-known brands of Duxbak, Bull's Head and Royal Extra Belting.

Concentrated Potash a Byproduct of Cement Mill

After-Treatment to Dilute Potash from Precipitation Process Gives 6 Pounds Potash Per Barrel of Clinker.

With potassium at its present high figure, it has been realized that a successful plan for recovery of this element as a byproduct in the manufacture of cement would prove most remunerative. Efforts to discover such a process have been redoubled of late, and success has finally come to the Riverside Portland Cement Co., located in southern California.

This company is now recovering 6 lb. of potassium sulphate for every barrel of clinker burned. This quan-



Potash Recovery Plant at the Riverside Portland Cement Co.; Evaporating Ponds in Foreground

tity at present prices is worth from 40 to 50c per bbl. of cement produced. On the pre-war basis the same material would have a value of about 18c per bbl., a figure which would still leave an attractive net profit, so that the new branch of the industry is not likely to be short-lived. The following statement was obtained from John Treanor, manager of the Riverside Portland Cement Company.

Clays and shale suitable for portland-cement manufacture vary in K_2O content up to values as high as $2\frac{1}{2}\%$. During the past year many portland-cement raw mixtures from Eastern manufacturers were examined in the Riverside laboratories and were found to contain from 0.8 to 1.25% of K_2O .

In the ordinary burning of portland-cement raw mix, from 40 to 50% of potash content is volatilized and leaves the kiln with the kiln dust. This volatilized potash can be recovered in the form of a more or less dilute salt by the installation of suitable dust-collecting systems.

The amount of potash recovered depends upon the efficiency of the collecting devices. The efficiency of the electrical precipitators varies from kiln to kiln; the best individual kilns give results as high as 80% of the potash volatilized, while individual treaters over other kilns have an efficiency as low as 55%. A 100-ft. rotary kiln, for example, may produce anywhere from 4 to 7 tons of dust daily, whose average potash content may range between 4 and 10%.

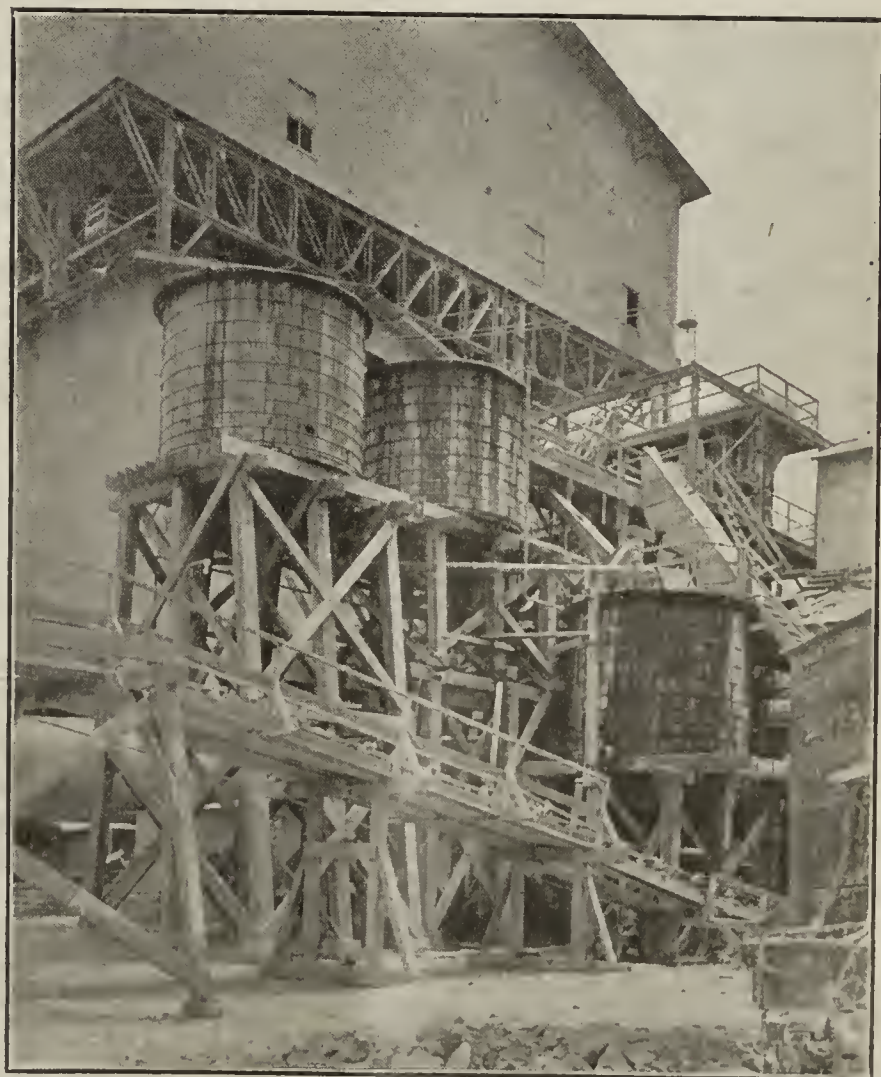
The potash contained in this dust is usually water soluble; or if part is insoluble, it will be amenable to further chemical treatment. This potash containing dust recovered from the kiln gases can be sold as dilute fertilizer just as it is. In fact, such a byproduct is regularly being produced by the Security Portland Cement Co., at Hagerstown, Md., and by the Alpha Portland Cement Co., at its plant on the Hudson River.

Dust Used as Fertilizer

The use of this dust, however, is restricted to agricultural operations requiring a lime-base fertilizer. It cannot be conveniently used as an ingredient for a complete fertilizer, on account of its dilute form. The cost of freight upon 90% of inert material is burdensome, reduces the net selling price and limits the available market. The usual requirements for complete fertilization work is a salt whose K_2O content is not under 35%, and it is toward this ideal that efforts have been directed in striving for a process for recovering potash from cement plants.

The potash recoverable from all cement kilns under all conditions will be in the form of potassium sulphate. During the past five years the laboratories at Riverside have been working on the problem of deriving a more concentrated salt from this dust. One of the obstacles, however, was that only 50 to 55% of the total K_2O originally present in the dust could be extracted in water-soluble form.

Recently it has been discovered that the cause of this poor extraction was the formation of a double salt of potassium and calcium sulphate which at ordinary temperatures has a low degree of solubility. This double salt is the mineral syenite, occurring in nature. After the cause of the poor extraction was known, it needed but a step farther to remedy it; and it was finally found that by keeping the mixture at a minimum of $85^\circ C$. during the leaching and filtering process, and maintaining proper conditions of concentration, all of the water-soluble potash originally present in the dust could be recovered. Patent No. 1,220,989 is based upon this simple fact.



Hot Water and Mixing Tanks and Belt Disposing of Filter Cake

For every 1% of K_2O in the raw mixture it would be theoretically possible with this process to recover 6 lb. of K_2O from each barrel of clinker, provided the volatilization is complete. Upon the pre-war basis of 3c per lb., this would amount to 18c per bbl., so that any economical means by which could be accomplished a better volatilization of K_2O from the clinker would be decidedly worth while. Working toward this end, a process was developed (patent No. 1,194,344) which makes use of calcium fluoride as a reagent for increasing the volatilization of potassium salts from the clinker and the regeneration of the reagent from the dust collected. This is accomplished as follows:

For every 1% of K_2O present in the raw mix, approximately 0.8% of calcium fluoride is added. This addition permits the formation of potassium fluoride, which is readily volatile and has a boiling point of



Bagging the Concentrated Potash Fertilizer

about $850^{\circ}C$. The reaction between the calcium fluoride and the potash in the raw mix, however, does not take place until a temperature of about $1100^{\circ}C$. is reached. At this temperature, which is far in excess of its boiling point, the salt will be rapidly expelled from the raw mixture and carried off with the gases of combustion and the dust.

This volatilized potassium fluoride, however, does not persist in this form. It is more or less completely converted by the oxides of sulphur in the gases of combustion to potassium sulphate. This transformation is accompanied by the liberation of hydrofluoric acid, which is immediately neutralized by the lime compounds in the dust and is converted into calcium fluoride. This dust is then leached by the process already described, and the soluble potassium sulphate is separated from the insoluble calcareous and argillaceous material by filtration.

Results of the Process

The filter cake obtained by this operation is useful raw mix, containing in addition to cement-making substances all of the calcium fluoride originally used, and in addition to this the deleterious constituent, lime sulphate.

Originally it was attempted to enrich the dust by reburning it; and although this gave a very rich potash dust, the operation was extremely uneconomical. In fact, only 20% of the total potash fed into the kiln in the shape of stack dust and treater dust was volatilized. The remainder, or 80%, was driven into the clinker.

The cause of this was found to be the calcium sulphate present in the dust. In the presence of fluoride, however, the calcium sulphate decomposes, which discovery was embodied in patent No. 1,219,315. This reaction then makes it possible to again return the filter cake containing among other things the calcium fluoride to the raw mix where the calcium fluoride

again performs its function of increasing the volatilization of the potash in the raw mix. By this cyclic process the volatilization at the Riverside plant was increased from 60 to 90%.

Summing up the possibilities of recovery of potash as a byproduct in portland-cement manufacture, the experience at the Riverside plant indicates that 90% of the potash contained in the raw mix can be volatilized, 10% remaining in the clinker; 80% of the potash so volatilized in the kiln should be caught by the dust collectors. The net product, about 70% of the original input, will be still further reduced about 5% by losses in filtering. It has been demonstrated by the work at Riverside that it is entirely conservative to look for the recovery, in the form of concentrated salt, of $66\frac{2}{3}\%$ of the potash originally contained in the raw cement mix, and it is quite possible that even these results may be improved upon by increase in the efficiency of the dust collectors. The resultant salt is received most enthusiastically by the fertilizer trade.

Mechanical Features of the Process

The dust is drawn from bins under the electrical treaters into tanks, where it is put into solution by agitation in water of not less than $85^{\circ}C$. at a concentration of not over 5% K_2O . The apparatus consists merely of cylindrical tanks some 12 ft. in diameter and 8 ft. high, which have on their axis a vertical shaft carrying ordinary propellers. The tanks are filled with water to a depth of about 6 ft., and the water is brought up to the desired temperature by means of steam injected into it.

The dust is then charged into this heated water, and the temperature rapidly rises to boiling point, due to the hydration of the lime contained in the dust. Samples are taken every few minutes, filtered, and specific gravity determined as well as percentage of solids. The potash goes into solution surprisingly fast under the conditions described. The whole operation of extracting the water-soluble potash from 7 tons of dust is accomplished in less than 50 min., and the whole control has reduced itself to a very simple basis.

As soon as a batch is cooked in one of the tanks, it is run by gravity into the filter reservoir under an Oliver filter press, where its temperature is maintained by steam coils, and the whole is kept at a homogeneous consistency by means of an agitator. The suction of the filter drum then forms a cake; and as the drum revolves, this cake emerges from the pulp and encounters a bank of hot-water sprays. Suction is applied automatically after passing this point, to remove as much water as possible from the cake, which, when it reaches the horizontal position of the floor level, is scraped off by means of a plow.

The solution thus extracted from the cake is passed directly to storage tanks, which are at the same time settling and evaporating ponds by means of solar evaporation, which is very active in the dry climate of southern California. When the liquid has attained a specific gravity of about 1.1%, it is pumped to the evaporating pans, where the liquid level is maintained at a fixed point and the solution becomes more and more concentrated and the salt drops to the bottom. It is then raked out upon a drain board, where it is allowed to remain some minutes, and thence is deposited in a hopper, where draining continues for several hours. From this hopper it is passed through a rotary drier, thence through a Williams mill where it is reduced to the desired fineness; and finally, the salt proceeds to a bin under the sacking machine.

Credit for the invention of the chemical processes employed belongs to Frederick W. Huber, chief chemist of the Riverside plant, and to his assistant, Frank F. Reath.



New Concrete Recreation Building in Washington Park, Chicago

Artistic Effects in Concrete Construction

There has recently been completed in two of the small parks under the jurisdiction of the Chicago South Park Commissioners, two groups of recreation buildings, and in connection with which more artistic effects have been attained in the molded concrete surface of the structure than has probably heretofore been accomplished in this kind of work. The unique feature of the construction is a rough surface in which fluted pilasters and a wide ornamental cornice of classic Doric design has been cast without showing the impression of the forms, thus giving the entire exterior walls a monolithic effect of remarkably pleasing and harmonious appearance. This style of construction was first introduced about ten years ago by the South Park Commissioners in conjunction with B. H. Burnham, a well-known architect of that city, since which time it has been developed by the commissioners until they have been able to produce the remarkably artistic features of the present structure.

The main group of buildings as shown in Fig. 1 is of cruciform shape, the length of which is 310 feet, and the width of the central portion 146½ feet. At the main or band plaza end of the structure is an entrance vestibule 15x21 feet with men's and women's toilets and cloak rooms at the side, and stairways leading to the second floor. The vestibule leads to the women's gymnasium and assembly hall, which is 46 feet by 79 feet 10 inches, with a stage 23 feet by 17 feet equipped with large dressing rooms in the rear at the end next to the center of the building. At the sides of the stage are passageways leading from the assembly hall to the men's and women's lockers located at the center of the group of buildings. On the second floor at the center of the entrance front is a large club room, and at its ends are wide stair halls connecting with the balcony extending around three sides of the assembly hall. At the ends of this balcony on both sides of the hall opposite the stage are small club rooms. The women's gymnasium is 24 feet high at the sides and 39 feet at the center, the roof being carried by open construction steel trusses supporting wood purlins and rafters. The entire structure is roofed with green Spanish tile. The balcony is 12 feet above the main floor, below which the side walls are faced with white enameled brick.

The balcony and main floors are of concrete construction with concrete base and maple floor finish in gymnasiums and double floor maple finish in the balconies.

At the end of the building opposite the women's gymnasium is that for men, the inside dimensions being 46 feet by 83 feet 9 inches. There are small rooms for apparatus at the sides of the outer ends on

both first and second floors. The general design is similar to the women's gymnasium with balcony extending around three sides. In the middle section of the group of buildings are the shower baths and lockers for the men and the women, the showers being arranged in the center of the building and separated by a central wall. Light and ventilation are provided through the medium of a very high ceiling with lantern light and passages adjacent to the showers covered with wire glass ceiling and a wire glass roof.

At the end of the main group of buildings in the rear of the men's gymnasium is a large open-air swimming pool, a power house and a service yard. The pool is surrounded by an ornamental brick and concrete walk with long concrete benches, and is connected with the locker and dressing rooms in the main group of buildings by asphalt walks on both sides. The pool is 130 feet long, 60 feet wide and divided into two sections. The shallow end is 60 x 80 feet, and is designed for a water depth of 2 feet at one end, tapering 4½ feet at the other. The deep end is designed for a uniform water depth of 8 feet. The walls and entire floor of the pool are faced with white enameled tile.

The standard thickness of the walls of the buildings, not considering pilasters and cornice, is 18 inches, composed of a 4-inch tile center dry mixed with 7 inches of concrete on the outside and 7 inches of wet mixed concrete on the inside. The dry mixed concrete is composed of two parts cement, three parts torpedo sand and nine parts broken stone which will pass through rings ¼ to ½ inch in diameter. The interior side of the wall is composed of regular wet mixed 1:3:6 concrete. The walls were built in 8-inch layers, the tile being placed first, then the surface concrete and the wet mixed concrete on the inside of the wall last. In placing the surface concrete it was tamped very hard for a width of about 5 inches next to the tile and very little at the front. By using very small stone of nearly uniform size and a dry mix tamped in this manner, it was possible to crowd the concrete forward into the molded design of the forms, thus bringing out every detail of the design and presenting a uniform rough exterior finish. In mixing the concrete for the surface only about one-third the quantity of water was used as for the wet mixed interior part of the wall. It is said that the inspectors of the South Park Commissioners attribute the artistic results obtained in placing concrete in this manner to the uniform small size of the stone, great care in securing evenly mixed concrete of uniform moisture and the skill in tamping, to crowd the concrete forward into the molded designs of the forms.



Plant of the Standard Portland Cement Co., Leeds, Ala.

Equipped with Williams Mill, 10 Fuller Lehigh Mills for Raw, 10 Giant Griffin Mills for Clinker Grinding, Smidth Tube Mill and a Ball Mill on Clinker and Automatic Weighing Machine Company's Scales.

One of the most successful cement manufacturing plants in this country is that of the Standard Portland Cement Co., located at Leeds, Ala. That the South offered an excellent opportunity for a cement plant was recognized by some South Carolina and Virginia capitalists who had participated in the success of a mill which had been established in Virginia.

After prospecting the South thoroughly there was found in the great industrial district of Birmingham a deposit of limestone high in quality and uniform in composition throughout. The deposit itself was especially adapted to economical mining. The prospectors were fortunate in finding adjacent to this limestone deposit heavy beds of shale of superior quality. But a few miles away was the famous Birmingham coal basin in which were veins of the highest quality of bituminous coal in inexhaustive quantity. The fact that the main lines of two of the great railway systems of the South, the Southern and the Central of Georgia, came together at Leeds also had much to do with the selection of this location.

Begin Modestly

So in 1905, the construction of a small plant was begun for it was decided to start in a small way and to let development come as the natural result of increased demand. Accordingly a one-kiln plant was constructed and this plant went through the usual vicissitudes of a manufacturing enterprise until the process was developed to an economical standard and the market for this new and untried brand was firmly established. Belief that the South would be a heavy user of cement was borne out almost beyond the expectations of the original investors and their permission and approval was constantly sought by the management for the enlargement of the plant to take care of the orders which continued to flow in, until at the

present time this plant is one of the most modern factories in the industry.

Scientific Drilling and Blasting

The limestone used is of the Chicamauga formation, which is of high quality and great uniformity. Drilling is done by means of a well-drill of the Cyclone non-traction type, which is operated by a variable speed motor. This drill is manufactured in Orrville, Ohio, by the Sanderson-Cyclone Drill Co. Six-inch holes are drilled to the bottom of the face and these holes are placed from 15 to 20 feet apart and about 15 feet back from the face. Two sides of the quarry are drilled in this manner, the holes are then loaded with Du Pont dynamite of high strength and all of them exploded at one time by electric current. From 25 to 30 holes are "shot off" at one time using from seven to eight tons of explosive. The holes are loaded in such manner that, when fired, the bottom of the face is kicked out while the top section falls down behind. The amount of dynamite and its placing in the holes are so regulated that the broken rock falls in a compact pile and does not scatter. One of these shots throws down sufficient rock to supply the mill for several months and while this is being sent to the mill the other two faces of the quarry are being drilled.

Transport by Gravity

Over the floor of the quarry narrow-gauge tracks converge from the face to a dumping cage. Small cars are pushed to the pile of rock and on each track are two men to load the rock. The loaded cars run down by gravity. Each holds a ton. The quarrymen are paid on a tonnage basis. At the point where these tracks converge is a dumping platform under which is placed a large car. Into this is dumped the contents of four small cars. This loaded car is then drawn up

an incline to the top of a large McCully gyratory crusher. The crushed rock drops on a 24-inch rubber belt which runs up an incline to large steel storage silos. From these the rock is conveyed to a Williams hammer mill which reduces it still further, the largest particles being not over one inch in diameter. A bucket elevator then carries the stone to a large circular, hopper-shaped steel tank over the scales where the stone first meets its coingredient the shale.

The shale quarry is located about a mile from the mill and has been opened in the valley floor to a depth of about 30 feet. This shale is of the Clinton, or Rockwood, formation.

Crushed and Weighed

After blasting it is loaded into small cars which are drawn up an incline to a Gates gyratory crusher. From this crusher it is elevated to a large steel hopper bin which is set over a spur track. "Gondolas" are filled with shale and moved to the mill by locomotive. Here they are run on a trestle under which is a large hopper provided with a feeding mechanism for uniformly feeding the shale into an elevator from which it is fed into a large rotary dryer. From here it is elevated to a ball mill which reduces it to small size. An elevator then carries it to either a large storage silo or deposits it on a belt conveyor running to a circular steel hopper over the scales. The scales are of the Automatic Weighing Machine Co.'s design; the limestone scale having a capacity of 800 pounds and the shale scale 400 pounds. Short belts feed out the materials from the hoppers above into the suspended weighing boxes. These boxes are connected electrically so that they dump at the same time into a hopper beneath which empties into a mixing conveyor. Here the two materials are thoroughly mixed and are conveyed to storage bins over the raw grinding machines.

Ground and Stored

In the raw grinding room are ten 42-inch Fuller Lehigh mills driven by vertical motors. These mills are set on foundations sufficiently high to deliver their discharge into a screw conveyor which runs beneath them for the full length of the room. The ground raw material, which is now a fine powder, is elevated to steel silos, the combined capacity of which is enough to permit a three-day shut down of the mills if ever necessary to make unusual repairs. This storage also makes it possible to shut down the entire raw department on Sundays.

At the Kilns

The coal is received in hopper-bottom cars which are run on a trestle under which is a large hopper. In the bottom of this hopper are swinging gates which distribute the coal on a belt which feeds a large dryer.

In the clinker grinding room are three vulcan kilns, each 7 feet in diameter and 100 feet long, and two Power & Mining Machinery Co.'s rotary kilns 9 feet in diameter and 125 feet long. The raw material is fed into one end of the kiln through a chute by means of a special rotary device which prevents flooding and insures a uniform flow of material. The amount of feed is regulated by cone pulleys.

Gypsum Added

The product from the kilns is known as "clinker" and discharges into elevators which drop it on the floor of a clinker storage which has a capacity of 100,000 barrels. Overhead runs an 8-ton crane equipped with a 3½-yard Ruddock clam-shell bucket which distributes the clinker to any part of the storage. After seasoning, the clinker is picked up by the crane and deposited in a large steel hopper bin, alongside of which is another bin for storing gypsum. Under these bins runs a belt and by means of special weighing

devices, the clinker, to which must be added a small amount of gypsum to regulate the setting of the finished cement, is carried to an elevator which discharges into a distributing conveyor and thence into the storage tanks of the grinding mills.

The Finished Product

In the clinker grinding room are 10 Giant Griffin mills, one ball mill and one Schmidt tube mill, the latter being lined with metal plates and charged with small steel balls. These mills reduce the clinker to an extreme fineness and the product from them is the finished cement. They discharge into a screw conveyor and the finished cement is carried by elevating and conveying machinery to the stock house where it is stored in wooden bins.

Packing

These bins are arranged in two rows, back to back. Along the front of each row runs a screw conveyor into which the cement is drawn by a drag line scrape operated by electricity from the outside of the bin. This conveyor discharges the cement into an elevator, at the top of which is a revolving screen for removing any foreign material which might damage the packing machines. Under the screen runs a conveyor which distributes the cement to hopper bins over the packing machines. There are three packing machines of the Bates, four-sprout type, set in line. Before



How the Rock Is Handled in the Quarry After Blasting, Conveying It to the Dumping Cage in Narrow Gauge Cars—Drilling Is Done with Cyclone Drills

these machines run a 30-inch rubber belt which extends the full width of the packing room. Boys sit on a bench before each machine, attach the sacks which have already been tied, and when each sack has been filled with cement to the proper weight it is tipped off by means of a tilting cradle on to the belt. This belt is connected so that it may be run in either direction. It carries the loaded sacks to the car door and two men in the car receive these sacks and with trucks deposit the sacks in orderly piles in the car.

100,000 Barrels a Month

At present the plant has a capacity of 75,000 barrels of clinker and 100,000 barrels of Standard brand cement a month. The packing department can pack and load 4,000 barrels of cement a day. The demand for cement has been so great that the plant is being operated at full capacity and the writer was assured on his recent visit that everything was running with clock-like regularity.

The town of Leeds is largely made up of employees of the company who have built their own homes. The company also owns a number of neat cottages, to which it supplies light and water free.

Adapting the Motor Truck to Its Work

Most business men, turning from horses to motor trucks for delivery service, have depended on their judgment, biased more or less by the arguments of truck salesmen, for the solution of the variety of problems that arise—what kind, size and make of truck to buy, selection and payment of drivers, safe speeds and loads, housing, repairs, tires, costs, etc. This has resulted, during the past five years, in much expensive experimenting which may now be largely eliminated by drawing on variously accumulated experience. The writer has had charge of one of the largest fleets of trucks in Philadelphia for the past four years (that of the Union Paving Co.) and in addition has made a study of truck transportation in general, which perhaps justify an attempt to outline answers to the above problems of the uninitiated.

The respective fields of gasoline and electric trucks are so clearly defined that only passing mention need be made of the electric vehicle. The present cost of current and limitations of construction greatly restrict the use of electric trucks.

The size (capacity) of truck and type of body will be determined by the nature of the business. Where a large quantity of material is to be moved, the five-ton truck should be chosen. For delivering in smaller quantities or for distributing a load to several points a two-ton truck will be most economical. Light delivery cars occupy a separate field and will not be discussed here.

The body should be built as low as chassis construction will permit. All unnecessary weight should be eliminated. In dump bodies the power hoist is more economical than the hand-operated one.

Regarding the make of truck, the writer's company strongly condemns the "low-first-cost" trucks. A buyer is more than justified in paying a higher price to get a reliable, well-known, standard truck. The practice of buying trucks of several makes for comparative purposes is not favored. Select what you find to be the best truck and then standardize. The saving through interchangeability of parts is self-evident.

We have tried both wood and metal wheels and greatly prefer the latter. Tires give greater mileage over metal wheels, and wheel troubles are entirely eliminated. Tires are supplied of two types—demountable and pressure applied

type will be found more satisfactory and should be specified unless the truck is to work in some remote section, inaccessible to a service station.

The truck should be lettered with the owner's name, and if more than one truck is used, with a distinguishing number. This number should also appear prominently on the back end of the body, as it is often desirable to identify a vehicle when only the rear end is visible.

After the truck has been selected and equipped, we may turn our attention to the details of efficient operating. The frequently expressed opinion that teamsters make the best truck chauffeurs is not borne out by experience. The model truck driver is one who has served some time in a machine shop or garage, young, preferably married, with at least a fair schooling, temperate and honest. Drivers should be paid a definite weekly wage. In addition, they should receive a monthly bonus, based on the miles traveled and the amount of gasoline used. This bonus stimulates interest and co-operation in the driver, the most vital factor in profitable operation.

Overloading and overspeeding are two prominent pitfalls to be avoided. Abusing any machine is short-sighted economy. But speed governors are not to be generally recommended; a good driver does not need a governor, and a poor driver can ruin a car in spite of one.

Under suitable conditions hauling costs may be reduced 15% to 25% by pulling a trailer in back of the truck. This should not be attempted where grades over 10%, or bad road surfaces, are to be encountered. When using a trailer, the truck ought not to carry over 80% of its rated load, while the trailer may take an equal amount or slightly over.

Where three or more machines are kept, the owner should have his own garage, in which practically all repairs can be made. Here a supply of gasoline and oil may be kept as well as extra brake bands, two spare wheels (one front and one rear) and other minor parts. Three mechanics should keep 10 or 12 machines running. This will be possible by a system of continuous maintenance, a thorough overhauling yearly and discarding trucks when they are worn badly.

Cost Keeping

Accurate costs should be kept on every truck installation. The extent of



Los Angeles Sand & Gravel Co.'s Fleet of Motor Trucks

detail will be determined by the number of trucks used and the relative cost of hauling compared to the entire cost of the material delivered. Most tire and truck companies distribute blank forms for recording daily costs. These are all similar in essentials and furnish an excellent basis for an accounting system.

The accompanying table shows a typical cost statement for a five-ton dump truck, giving each item entering into hauling costs and the necessary averages:

Cost Statement for Five-Ton Dump Truck

Fixed Charges

	Per Day
Depreciation* (\$4,100-\$400 scrap value÷1,200 days)	\$ 0.46
Insurance (liability, fire and collision)	.58
License fee	.10
Truck foreman (supervising three trucks)	1.25
Driver	3.00
Total fixed charge per truck	\$ 5.39

Variable Charges

	Per Mile
Depreciation* (\$4,100-\$400 scrap value÷50,000 miles)	\$ 0.0629
Gasoline @ 25c (3 mi. per gal.)	.0833
Lubricating oil (64 mi. per gal.)	.0055
Tires (on guarantee basis)	.0386
Repairs	.0600
Total variable charge	\$ 0.2503
Fixed charge (at 50 mi. per day)	.1078
Total cost per mile	\$ 0.3581
Total cost per day	17.91
Total cost per ton-mile	.1433

*About 15% of the first cost depreciates with the passage of time, while about 85% is directly proportional to the miles run.

A New Schieren Belt Factory

Manufacturing will begin immediately in the new plant of the Chas. A. Schieren Company, of New York City, built as an addition to its tannery at Bristol, Tenn.

The buildings are entirely completed and the equipment of machinery is being installed for the manufacture of the highest grade machine belts, the greater portion of which will be shipped to Southern plants.

A working force sufficient to produce 24,000 lineal feet of belting daily will be employed at the start and gradually added to, as skilled help can be secured, until the full capacity of the plant, 50,000 feet daily, is reached.

The Schieren Brands of Belting, well known throughout the world, are Duxbak (waterproof), Bull's Head, Royal Extra, CasCo, etc.

"The Reeves" Wood-Split Pulley

"The Reeves" Wood-Split Pulleys are made in all sizes up to 30-foot diameter. Being fitted with interchangeable bushings they may be changed from one shaft to another of different size at an expense of a few cents for a new bushing.

Stocks carried in all jobbing centers.

Catalogue T-16 on request. Reeves Pulley Co., Columbus, Ind.

Link-Belt Company

The Link-Belt Company's latest publications deal with "Chain Drives" for Motor Trucks and "Roller Chains" for Tractors and Trucks. The first booklet gives the various reasons why 80% of all trucks made are chain driven and the second illustrates the "TT" Class Roller Chain manufactured by the Link-Belt Co., Chicago, who will be glad to send copies of these pamphlets to anyone desiring information.

Promoting the Flow of Concrete in Pipes and Forms

In the \$3,500,000 Twin Peaks tunnel, San Francisco, the contractors, R. T. Storrie & Co., have been successful in conveying concrete 2,600 feet through an 8-inch pipe by the pneumatic placing process which will soon be extended to a distance of 4,000 feet or more.

This concrete is mixed with hydrated lime added for a lubricant which acts through its ability to hold water and prevents segregation, thus allowing the concrete to be mixed better than would otherwise be satisfactory.

In a recent letter to Pierre N. Beringer, publicity manager of the Ransome Concrete Machinery Company, M. M. O'Shaughnessy, city engineer of San Francisco, under whose direction the tunnel is constructed, says: "I believe the conveyance of concrete by pipe is a great achievement and the interesting part of the work is that it carries uphill on a 3 per cent grade better than on the down grade. The reason for this is, I presume, that the material acts like a wad in a gun and is pushed forward in a mass on the uphill grade, whereas on the downhill grade it is scattered.

"Experiment at other points in the mixing and placing by the use of pneumatic machinery has demonstrated the value of the use of hydrated lime beyond a doubt, both as an aid in reducing friction in transit of the aggregates as well as improving the quality as to waterproofing."

A letter from Charles A. Erbach, secretary to George P. Cullen, contractor for the concrete operating houses of the Belmont Avenue Bridge, Chicago, says that the walls of the structure were of ornamental reinforced concrete containing about 200 cubic yards of concrete mixed with one bag of cement, 2 cubic feet of sand, four cubic feet of 1/2-inch crushed limestone, and 10 pounds of hydrated lime.

The forms, only 6 inches wide, were so much obstructed by the expanded metal and steel reinforcement members that there was very little room for spading the concrete and the contractors feared that the concrete would be honeycombed, spotted, and discolored and containing voids as in a former job of similar nature.

To prevent this hydrated lime was added to the concrete mixture and a clean white wall free from rough spots was produced. The concrete flattened out so easily in the forms that no spading was required or attempted.

The hardened concrete gave out a clear ringing sound and brought out the beauty of the design. When finished the cost was found to be lower than on previous jobs of similar character.

In his opinion the value of hydrated lime in concrete is that it should be used on all concrete work. The effect it has on the finished concrete is so convincing, the labor it saves so great, and the cost so small, that he considers it indispensable to contractor and engineers alike.

Street and Road Pavements

Their Design, Construction and Maintenance

"If the best concrete roads are to be constructed," states Mr. A. N. Johnson, consulting highway engineer, Portland Cement Association, "more attention must be paid to the nature and character of the concrete. Definite proportions having been adopted for the cement and aggregates, the quantity of water plays the most important part in the strength of the resulting concrete.

"The problem before the practical road builder is how to secure as nearly the right amount of water as possible. Owing to the variation that exists in the aggregates, it is difficult to secure the precise amount of water that will give the maximum strength with a given amount of cement and aggregates. Moreover, as the exact amount of water for maximum strength gives a rather stiff constituency, there is the practical difficulty to get the foreman in charge of the work to use such stiff mixtures. Therefore, it is necessary to use a small surplus of water in order to manipulate the concrete readily and work it in place. This excess of water, however, can be corrected to a large degree by the subsequent manipulation which the concrete receives.

"All who have examined the concrete pavements laid at Sioux City, Iowa, and Macon, Ga., have remarked upon their uniform excellence. This excellence is not to be accounted for alone by the fact that good aggregates were used, or that soil conditions were peculiarly favorable because good aggregates have been used in many places and the soil conditions in Sioux City and Macon present a variety of conditions.

"There is, however, one outstanding feature in the construction of the pavements at both of these places, which in the opinion of the writer, is the chief cause for the uniformly excellent results obtained, and that is the concrete is so manipulated that the excess water it contains is removed.

"The method used to accomplish this in Sioux City, while effective, is more expensive and not as satisfactory as the method developed in Macon, Ga., by Captain J. J. Gaillard, city engineer. Captain Gaillard's method consists of rolling the concrete with a light hollow sheet steel roller about 6 feet long and 8 inches in diameter, in which are inserted wooden ends and supporting an axle, to which a bail is attached carrying a long handle. The details of such a roller are shown in accompanying sketch.

"The manipulation of this roller is as follows: Immediately after the concrete has been

struck, or placed, it is rolled by moving the roller transversely across the street or road. In case of an exceptionally wide street the handle is long enough to reach a little more than half way across the pavement. On a narrow street or ordinary country highway the handles will be long enough to enable the workmen to roll the entire width of the road, working from one side.

"The effect of the roller is that of a rolling squeegee—it consolidates the top layer of the concrete and removes practically all of the surplus water. At the same time, it takes out the slight uneven places in the surface which may occur, particularly if the pavement has not been struck by a template. The rolling should be continued until free water ceases to come to the surface, when it is ready to be finished by the canvas belt. The effect of the belt is to give uniform, gritty texture to the surface.

"With the use of rigid types of pavements, or pavements which rest upon a rigid base, the methods that have been devised for measuring the wear of macadam roads are open to considerable error, aside from usually clumsy. Most of these devices provided for reference points at the sides. But where the pavement consists of a rigid slab or rests upon one, the observations that will be secured from a straightedge or wire stretched across the road are often quite useless, due to the movement of the slab and the possibility of its fracture because of unequal settlement. The method here proposed will overcome such difficulty and is also extremely simple and convenient.

Simple Device for Measuring Wear of Concrete Pavements

A drill hole $\frac{1}{2}$ -inch in diameter is made in the pavement. In the case of a concrete pavement, it may be 2 or $2\frac{1}{2}$ -inches in depth. In the bottom of the drill hole is set a copper plug about $\frac{3}{4}$ -inch long, with its top made semi-spherical. The plug is imbedded in the

hole with cement paste. A short steel scale divided into inches and hundreds, small enough to be placed in the drill hole, is provided. At its end is a small button with conical under-surface, which is to rest on the spherical end of the copper plug. Across the surface of the pavement bisecting the drill hole is stretched a fine thread, and measurements are made with a scale. The hole is then filled with a wood plug, left flush with the surface, which is to be removed when subsequent readings are to be made.

A better and prob-



Stretch of the Toronto-Hamilton Highway Which Called Forth a Strong Endorsement of Concrete Roads from the Christian Science Monitor, of Boston, Mass.



Noccalula Falls Concrete Bridge, Luten Design, Recently Built Over Black Creek, Gadsden, Alabama—Span of Waterway 56 Feet. Roadway 18 Feet—For the County Court of Etowah County, Gadsden, Alabama

ably more convenient method would be to have a U-shaped handle, which will span about 6 inches, having flat ends on the legs. Drawn between the supports is a tightly stretched thin thread or wire 1 inch from the surface of the pavement. This is to be held so that the thread will be over the center of the drill hole. The flat ends of the legs rest on the pavement surface and the measurements are made to the thread. The fact that the thread is raised above the pavement will make it possible to read the scale more conveniently, and is an easy method of holding the thread. The bridge or U-shaped handle holding the thread may first be placed longitudinally with respect to the pavement, then transversely, and in as many other positions as desired, the average of all readings is taken. The handle may be made of hardwood, with metal-shod legs, or of a bent hollow brass tube about $1\frac{1}{2}$ inches in diameter.

This simple method will give, it is evident, data from which the exact wear at any point of pavement is desired. A line of drill holes, spaced about 15 inches apart, at various places in the pavement, would give sufficient data to determine the variation in the wear at different points. In the case of concrete pavements these data would be of special value to determine what influence variations in the materials of the concrete had upon the wear. The accompanying sketch illustrates the apparatus.

Machine Finished Surface

"The striking and finishing of the surface of a concrete road or pavement is an operation which demands the exercise of intelligent and painstaking labor," states Mr. M. DeGlopper, County Engineer, Oakland County, Mich.

"Its hard, unyielding surface cannot be altered after construction; any depression and unevenness of the surface, which is sure to follow crude or improper finishing, always remains. These not only result in discomfort to the traveling public, but a greater degree of wear results if the surface is uneven.

"Contractors must understand that good workmanship means better prices. No community will stand being 'stung' more than once, and in the future the com-

petent, painstaking road builder will find his services in ever increasing demand.

"The first essential in getting a good finishing surface on a concrete road, whether hand or machine finished, is the right kind of side forms, and the placing of them to the exact grade. If they are too weak, so as to bow out between stakes, the pavement will sag, causing a depression at the crown. If they are warped vertically, a rise or fall will occur at the centers and where they join. Get the best side forms and keep the concrete off the top of them.

"If finished by hand, the next important thing is the strike. It not only must be strong, rigid and durable, but light enough to be operated by as small an amount of labor as possible. Rigid to retain the desired curvature and withstand the pressure of an accumulation of concrete. It must be shod with steel on the under side, where it is curved to the exact crown of the road.

"Here it might be stated that a circular crown to a road or pavement is the easiest thing to produce. If the attempt is made to make a parabola top (one that is flatter at the crown and the curvature increases more abruptly toward the edges), with a strike having that curvature on the under side, it must be pulled straight ahead, as any sawing of the strike over the side forms, as is usually done, will result in a deformed surface. The circular crown permits the strike to be drawn back and forth without changing the crown.

"Strikes for wide construction, 20 feet or more, require a man at each curb and at each quarter to assist in pulling the strike forward by means of light iron rods hooked to the strike. The general method is to pull it slowly forward and at the same time work it transversely back and forth with a sawing motion. This must be repeated a number of times to produce satisfactory results.

"The finishing of the road or pavement by hand is a delicate operation. More concrete surfaces have been ruined by inefficient handling of floats and trowels than any other way. Floating must be done from a bridge, as the depression left by plank laid on the soft concrete or the track of the workman will be floated full of soft material by the finisher, and depression will result.

"The purpose of floating is to smooth out any unevenness which may appear after the strike has passed over it. Hand floating is expensive and a source of constant annoyance to the contractor, who usually cannot get finishers sufficiently skilled to produce a smooth, even surface. To overcome their difficulties and to permit the making of a more perfect wearing surface than could heretofore be obtained, we operate a Baker Automatic Finishing Machine.

"Perhaps a better idea of the advantages of this machine can be drawn by means of a comparison between the hand and machine methods of finishing. First, consider the merit and concrete requirements of the old method (hand strike and finish):

1. A very wet and even sloppy consistency of concrete is usually maintained in an attempt to force the filling of the voids. This leaves many weakening invisible pores, increasing the possibility of high moisture content.

2. A very wet mix is necessary to provide sufficient time for tamping, striking and floating before the initial set takes place.

3. The wet mix, when used, produces a wavy surface, especially on grades, the tendency being for the mortar to creep away from the crown to the sides or bottom, leaving a flattening effect. This is contrary to specifications, but is unavoidable with a wet mix. Most specifications require a concrete to be so plastic that it will flush readily under light tamping and at the same time be so dense that there will be no separation of the mortar from the aggregate. This is inconsistent. One condition or the other must prevail.

4. Hand striking and floating is slow, tedious and expensive work, requiring at least four or five men for this part of the work.

5. Inability to finish the surface as fast as the concrete is placed on the sub-grade very often results in the necessity of retempering the surface for smooth finishing. This retempering, resorted to after the concrete has started to set, very often destroys the bonding characteristic of the cement and causes rapid wear and dusting on the surface.

6. Hand floating leaves a deceiving surface. It may appear to be smooth, but the presence of numerous small depressions is discernible upon the evaporation of the water. Quite often, while the floating is being done, these depressions are replenished with a little additional concrete or mortar. This does not leave a proper bond between the depression already floated and the added material, which is liable to form a crust.

7. In hand tamping, as usually performed in conjunction with the striking, the compressive force can only be applied to a very small surface at a time. As soon as the tamp or strike is raised, the mortar and excess water rush into the depression formed, leaving a surface which is not uniform in consistency.

8. The principal reason for advocating a wet mix is that no tamping will be necessary, and consequently the workmen will not be compelled to walk on the concrete. The advocacy also implies that the weight of the material and fluidity of the mortar will furnish the required density.

9. The placing of an excessive amount of concrete results in the riding of the strike and increases the labor in floating and the attending chance for surface waves.

10. To secure satisfactory results, the operation of the strike must be repeated at least two or three times over the entire area.

11. The attempt to secure a hard surface is often made at the sacrifice of a true crown, the tendency being to rub the material out until the surface is flat.

Conclusions to be drawn from the abuses of the hand

striking and floating method lead in most cases to faults due to the very wet mix used and to the element of human labor. If these conclusions are correct, then why should we refuse to believe that any other method of performing this work, after the two faults mentioned have been removed, is likewise improper? From careful observation I have drawn the following conclusions on the advantages to be secured by use of a mechanical means of finishing and striking the concrete:

1. It is entirely unnecessary to use a wet mix; in fact, a more dry mix is very advisable. This will greatly increase the ultimate strength of the concrete.

2. It is not necessary to increase the water content to our roads in 30-foot sections between the joints and the total, allow sufficient time for striking and floating. Instead of waiting for the finishers to catch up, the machine is waiting for more concrete. We have only been able to lay 600 linear feet of roadway per day, and consequently do not know what the real capacity for work of the machine would be. However, it is safe to place this figure at from 900 to 1,000 feet per day.

3. Waves in the surface are dispensed with. The strike moves transversely and leaves just enough excess concrete for compression to the final grade. The compression pan is placed at a slight angle to permit a more uniform and gradual compression on the concrete. The material under the pan at all sections receives the vibrated compression for a period of about one minute, and more if desired. After the pan has passed any section there are three noticeable features apparent at once, (a) none of the coarse aggregate is exposed at the surface; (b) there are no collections of water on the surface; (c) just enough excess mortar has been brought to the surface to provide a smooth, strong, impervious covering. The surface is left in an ideal condition for the finishing float which follows. After the completion of the float's work, the appearance of the surface is self-evidence of the completeness of the task. Not a wave in the surface, a perfect crown across the entire width and no exposed aggregate.

4. Compare the cost itself of striking and floating with that involved in the other method. The hand method requires at least four or five men. By the use of the machine, only one attendant is necessary, and it might be added that the only necessary qualification he must possess is a willingness to take an interest in the work. Any man who can operate a gasoline engine can operate a Baker Finishing Machine.

5. Possibility of speedy work removes the possibility of having to resort to the abuse of retempering.

6. The vibrative compressive force takes place over a wide section, and there is no flow of mortar into a section previously compressed.

7. A wet mix dispenses with tamping, but weakens the concrete. On a more dry mix the machine produces this tamping, resulting in a very dense concrete, free from practically all air bubbles and seepage voids, without a separation of the mortar and aggregate.

8. It is impossible for the machine to ride the concrete, the trucks being fitted with bracket scrapers mounted ahead of the wheels to keep the rails clean. Consequently, there is no tipped effect, and the road must be down to the proper grade across the entire cross section.

9. Only one forward operation is necessary for thorough completion of the work. Machine has no reverse speeds.

10. The vibration produced is crystalline in effect, leaving a surface that is hard, smooth, dense and impervious. The finished work is practically monolithic in structure.

11. No appreciable time elapses between striking and floating, as occurs in the old method. From the

LOGLIFE **CONVEYOR BELTS**

will never lose their position of vantage in the belt market. They are too consistently good.

“LOGLIFE” Conveyor Belts will continue to be found at the front—where the fire is the hottest, where the grinding toil is a daily heart test, where each day’s charge leaves the fittest the victor on the field.

“LOGLIFE” towers over its competitors in name, fame and character.

It is aptly named because it is without contradiction the longest lived Conveyor Belt made by the hands of man.

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Makers of the Celebrated Goodrich Automobile Tires—
“Best in the Long Run”

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Akron, Ohio



Representation
Everywhere



time any section has been subjected to striking until it is floated and completed but $2\frac{1}{2}$ minutes have elapsed.

The Belt Finish

Finishing the surface of a concrete pavement by means of a belt drawn across the pavement with a saw-like motion, instead of by the customary methods of wooden hand floats, has given most satisfactory results in Utah. At first there was some hesitation in using this method on wide city streets. It was thought that a belt 30 feet in width or over would be difficult to handle. Notwithstanding this doubt, J. M. Tracey, City Engineer of Ogden, determined to experiment with the belt method on Van Buren avenue, a street then being paved with concrete, 49 feet between gutter lines. The belt was of canvas, 51 feet long and 12 inches

wide. With the exception of lifting and removing the belt from one place to another, two men were able to handle it almost as easily and with equally as good results as on slabs of much narrower width. The process of lifting to remove the long belt was made comparatively easy by utilizing the bridge.

Levi Muir, Assistant Engineer of the Utah State Road Department, applied the same method later, using two 15-inch belts, one leather and the other canvas faced with rubber. In the beginning the leather belt was drawn over the surface, and an additional smoothness was given by drawing the rubber side of the canvas belt along the work. After numerous trials the leather belt was abandoned, and only the rubber-faced canvas one was used.

The Texas Trap Rock Company's Plant

For the purpose of developing a dome of basalt located on the west side of the Frio River, just south of the main line of the Southern Pacific Railway, in Uvalde county, Texas, the Texas Trap Rock Co. built a very interesting and complete heavy-duty crushing plant and opened up an extensive quarry.

The presence of basalt in the coastal plain region of Texas is due to igneous action in the vicinity of the Balcones Escarpment. This basalt dome is just south of and on the down-thrown side of the fault that produced the escarpment in this immediate vicinity. The faulting and basaltic extrusion occurred in late cretaceous time. The rock is a nephelite basalt closely resembling the trap rock of Maryland and New Jersey. It has a crushing strength of over 30,000 pounds per square inch, is very tough, crushes in cubical form,

very favorable as a quarry location. Because of railroad facilities and occasional floods in the Frio, it was found necessary to locate the crushing plant on the other bank of the stream at an elevation 25 feet above the quarry floor. Quarrying is accomplished by drilling horizontal toe holes 20 feet long and 6 to 8 feet apart. Three and five-eighths inch Hy-speed air drills are used, and holes are sprung and loaded with dynamite. Blasting breaks the basaltic columns and the shock of the explosion traveling along cleavage planes causes them to fall forward. Occasionally large masses are block-holed and reduced to handling size by use of jack-hammer drills.

The rock is loaded by hand into low underslung steel cars of three tons capacity, especially designed for hand loading. These cars are taken across the Frio



View of Quarry Showing Track Arrangement and Loading Spur.

and makes an excellent material for the wearing surface of country highways or city pavements, as well as being one of the best possible coarse aggregates for a real fireproof concrete.

The quarry is on the northeast side of the hill. The working face is from 50 feet to 80 feet high, and the basaltic columns stand on end with a slight inclination from the vertical.

Erosion by the river had produced a cliff resembling the Palisades of the Hudson on a smaller scale and



Crusher Plant with Loading Tracks on Spur of Southern

River on a bridge and hauled up an incline 900 feet long with a 6 per cent grade to the crusher dump. This incline is operated by a steam hoist, which hauls up the loads. The empties return to the quarry by gravity overhauling the cable.

At the crusher dump the end gate of rock car is automatically released and rock falls into a No. 8 Gates breaker. The output from this primary crushing passes over a steel grizzly, which separates all rock under three inches from the oversize. The oversize

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Everything a batch mixer ought to have is contained in this machine.

Our Tilting Drum guarantees a perfect speedy mix—single opening, large capacity, easy to load and unload and always clean.

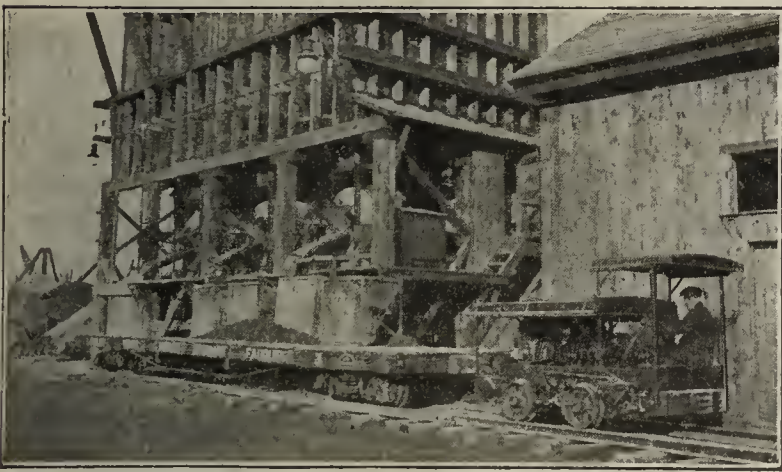
The Drum is entirely open to view at all times.

The Mixer has proven by test to be most economically operated.

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The Plymouth Hauling Concrete for Foley Bros., Welch, Stewart & Fauquier

"Saves Yard Haulage in Contract Work"

—Says McArthur

Foley Bros., Welch, Stewart & Fauquier, general contractors, Halifax, N. S., have two Plymouths employed constantly in general yard switching and hauling concrete on the job. C. D. McArthur, chief engineer for this firm, found that—

The Plymouth
Friction-Drive Gasoline Locomotive
Cuts Haulage Costs One Half

It costs less to buy, less to install, less to operate, and less to maintain. It takes heavier loads up-grade, uses full power of motor in high or low speeds, goes at ALL speeds up to 12 miles, and moves quicker without jerk or jar.

MR. McARTHUR PROVES ALL THIS

"The Plymouth Locomotives are entirely satisfactory to us," he says. "We find them of great help in our yard work and we find it would be hard work to get along without them."

THIS BOOK TELLS

We have a book that tells the complete story of these contractors as well as other owners of Plymouths. It is also full of cost data and valuable information regarding haulage problems similar to your own. A copy for the asking—send for it today.

THE J.D. FATE CO., 220 Riggs Ave., PLYMOUTH, OHIO

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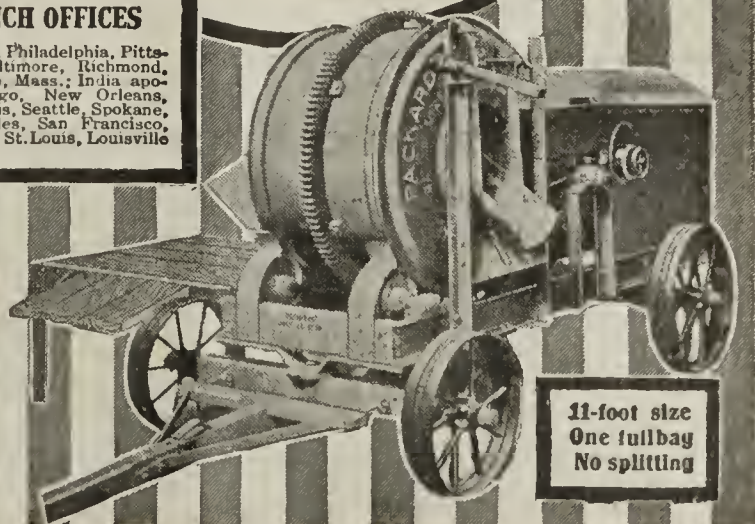
Easy Cleaning Low Charger

Specially made for fast work handling stiff concrete for Curbs, Sidewalk Work and Foundation Work. Hinged Low Loading Platform, only 24 in. high. Patented High-Speed Mixing and Discharge Action. Mixes Mortar and Plaster. Built of Steel. Light, Strong, Durable. 2 Sizes—6 and 11 ft. Power loader or batch hopper if wanted. Sold on the "Money Back" plan—cash or easy payments—price astonishingly low. Prompt Delivery from Stock. Investigate now. Write, phone or wire nearest branch office for full information on this mixer, also on Grouters, Pavers, Hoists, Pumps and Back Fillers.

The American Cement Machine Co. Inc
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THE 300,000 HP ELECTRIC CITY

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New York, Philadelphia, Pittsburgh, Baltimore, Richmond, Cambridge, Mass., Indianapolis, Chicago, New Orleans, Minneapolis, Seattle, Spokane, Los Angeles, San Francisco, Cleveland, St. Louis, Louisville



**11-foot size
One full bag
No splitting**

rock goes into a No. 5 Gates breaker, which gives it the proper reduction. Rock passing grizzly and No. 5 breaker goes into a large elevator, which takes it to the screen-house. Here it passes through a circular revolving screen, which separates it into commercial sizes, and it is then stored in bins under the screen-house and over railway tracks. On account of a demand for a rock one-half inch and under, a 30x14-inch crushing roll was installed, which is fed with three-quarter-inch rock from screen-house when an extra quantity of small-sized trap rock is wanted. On account of the hardness of rock, mantles and concaves of breakers are of manganese steel. The same material is used for crushing roll shell and chute linings. Power is furnished by two 125-horse-power Murray fire-tube boilers burning Mexican crude oil, which supply steam to a 20x42-inch Murray Corliss engine and an air compressor with a capacity of 550 feet of air per minute. Fuel economy is obtained by Schure oil

Cement Mill News

The splendid record being made by Charles E. Ulrickson, general manager of the properties of the Trinity Portland Cement Company, is in keeping with his former activities in Jackson, Mich., says the Jackson Tribune. Mr. Ulrickson formerly held positions in Jackson as assistant postmaster and superintendent of public works. Since assuming control of the huge cement plant, about eight miles out of Dallas, Texas, he has decidedly increased the output of that concern, by the introduction of his Northern "pep" and practicable ideas.

The Trinity Portland Cement mills at Dallas are the largest in Texas. Nearly three hundred men are employed and the output exceeds a million barrels a year. Several hundred acres of ground are contained in this one enterprise.

Last year, Mr. Ulrickson conceived the idea of leasing a farm for the benefit of his employees. This land



At the Plant of the Texas Trap Rock Co., San Antonio
No. 8 Gates Crusher—Below It Are Two No. 5 Gates Crushers, a 30" Set of Crushing Rolls and 48"x20' Allis-Chalmers Screens With Jackets, Giving 7 Sizes. 70-foot Quarry Face.

burners on boilers, a Webster heater and Wheeler condenser. As the plant is located in a section where all surface streams are dry except during floods, it was necessary to drill for water. Wells with a plentiful supply of water are extremely hard to get in the vicinity, and an exhaustive geological study was required to determine proper location of well. This was successfully done, and an abundance of excellent water is available, standing at a level of 200 feet below the surface of ground, the well being 946 feet deep. A 6-horse-power gasoline engine runs generator for lights and simultaneously pumps water sufficient for the day's run of plant.

The Texas Trap Rock Co., of which A. H. Muir is general manager, has its principal office in San Antonio, Tex. Douglas Muir is superintendent at Knippa, Tex. Bartlett & Ranney, Inc., consulting engineers, of San Antonio and Dallas, Tex., were designing and supervising engineers for the development.

New Agency in Oregon for S. & M. Dragline Excavator

The Hesse-Martin Iron Works, East Seventh and Belmont streets, Portland, Ore., have taken over for the State of Oregon, the agency for the Shearer & Mayer dragline excavator bucket, manufactured by Sauerman Brothers of Chicago. The Hesse-Martin people make a specialty of designing and manufacturing gravel screening and washing plants in connection with which this bucket can be used to the greatest advantage.

has been utilized entirely this season for the growing of vegetables and has been worked by the employees on a community basis. As an experiment, the famous Michigan Osage melons were introduced into Texas soil on this farm. The success of the experiment exceeded Mr. Ulrickson's hopes and next season it is likely that an extensive acreage may be cultivated for this purpose alone.

Olaf T. Avnsoe, mechanical engineer with the Iola Portland Cement Company, Iola, Kan., has become associated with the Cuban Portland Cement Company, Mariel, Cuba.

Stockholders of the Continental Portland Cement Company of St. Louis were notified yesterday that the semi-annual dividend of 3½ per cent had been declared on common and preferred stock and also an extra dividend of 1½ per cent on common and preferred stock. In addition \$80,000 bonds were retired. The earnings for the first six months of this year were \$115,000, compared with \$52,000 a year ago. One-half of the stock is held in Columbus and vicinity.

One of the most important manufacturing industries of the Southwest has received an impetus by the advent of the Southwestern Portland Cement Company, in the completion and operation of their new plant at Victorville, San Bernardino county, California, and its product is now on sale.

This plant has been constructed to provide for an output of 500,000 barrels of cement annually. The buildings and quarters for employees are of the most substantial nature and every effort has been made to

YOUR CHANCE

**Silos
Water Tanks
Coal Pockets
Grain Storage**

Built of
CONCRETE
by the
**POLK
SYSTEM**

NEXT YEAR concrete for silos, water tanks, coal pockets and grain storage comes into its own. The demand for conservation of food and fuel supplies means that there will be an enormous increase in the nation's storage capacity. The price of steel makes the use of steel prohibitive.

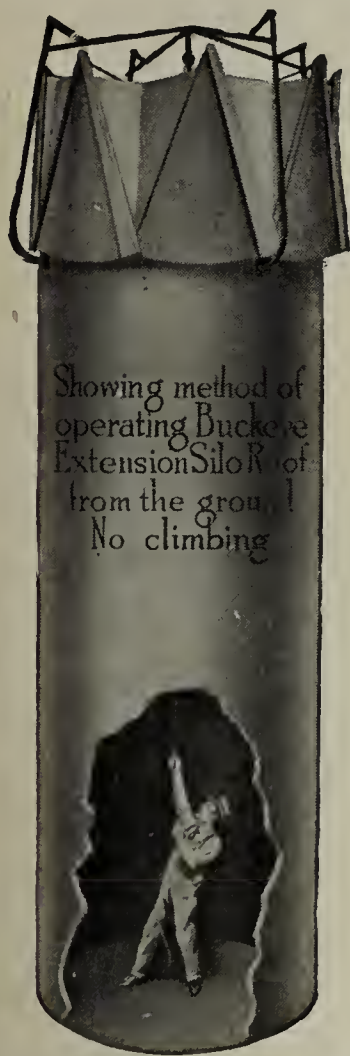
NOW is the time for concrete contractors to get a good start in the business. One POLK SYSTEM monolithic structure built this fall means a dozen paying contracts early next spring. It opens the way for a big construction business with those people who will get the cream of the war-time prosperity.

THERE is another good reason for starting NOW. You can still buy POLK SYSTEM all-steeled machines at a remarkably low price. They are only 10% higher, although the steel used in their construction has advanced 350%. It costs very little to get started.

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BUCKEYE Extension Silo Roof

Can be opened and closed
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EVERY user of ensilage will appreciate the superior advantages of the Buckeye Extension Silo Roof, because it is the simplest and most efficient extension roof on the market today.

The Buckeye Extension Roof is patented and has the unqualified endorsement of many satisfied users.

The Buckeye Extension Roof fulfills the proper functions of a Silo Roof in every particular with the added advantage of the extension feature.

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The Largest Manufacturers in the World of Metal Silo Roofs and Silo Accessories
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CORRECT SYSTEM SILOS

Caldwell Silos
meet every demand

WHY the constant re-orders from farmers for Caldwell Stave Silos throughout the country?

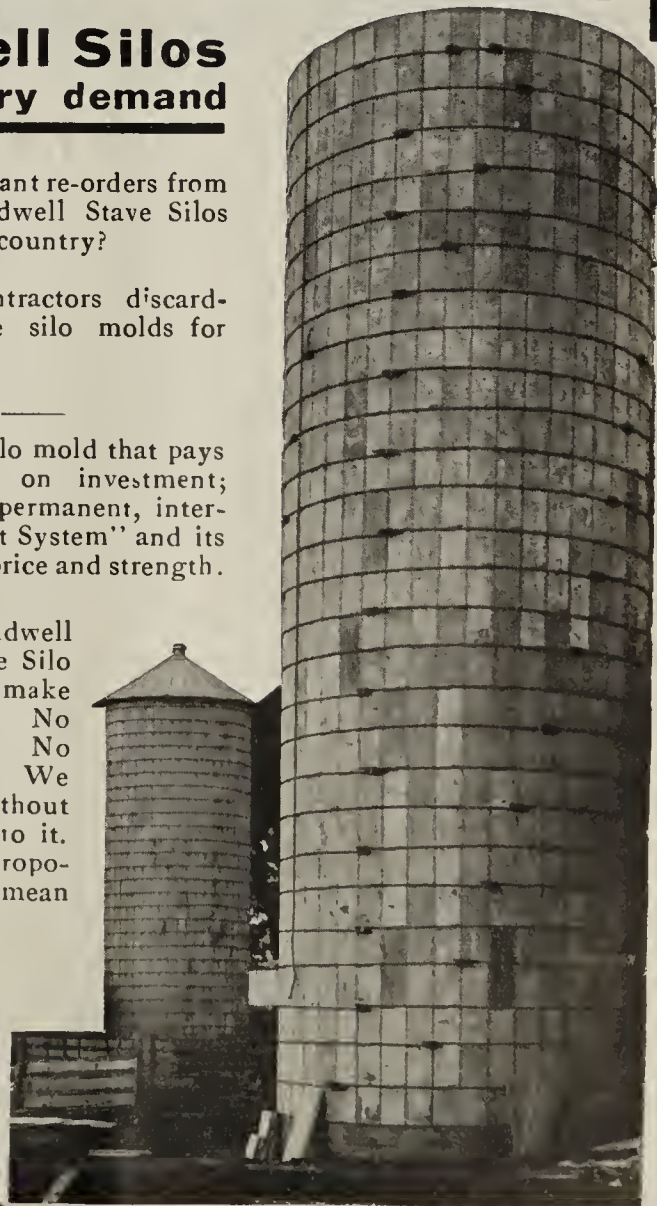
WHY are contractors discarding other stave silo molds for Caldwell's?

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the only stave silo mold that pays large dividends on investment; because of its permanent, interlocking "Correct System" and its simplicity, low price and strength.

Buy a set of Caldwell molds and make Silo Staves as you make building blocks. No royalty to pay. No territory to buy. We sell the outfit without strings attached to it. This is a good proposition and it will mean money to you.

Co-operative
Concrete
Construction Co.
OSKALOOSA, IOWA



insure comfort and convenience. A conspicuous feature at the works is an immense concrete smokestack which rises to the height of 185 feet. The main building of the plant is of the most modern reinforced concrete type and is equipped with the latest machinery for cement making. The plant is operated by electric power supplied by the Southern Sierras Power Company. An excess of 1900 horsepower is acquired.

The Southwestern Portland Cement Company has just increased their capital stock from \$2,200,000 to \$2,800,000.

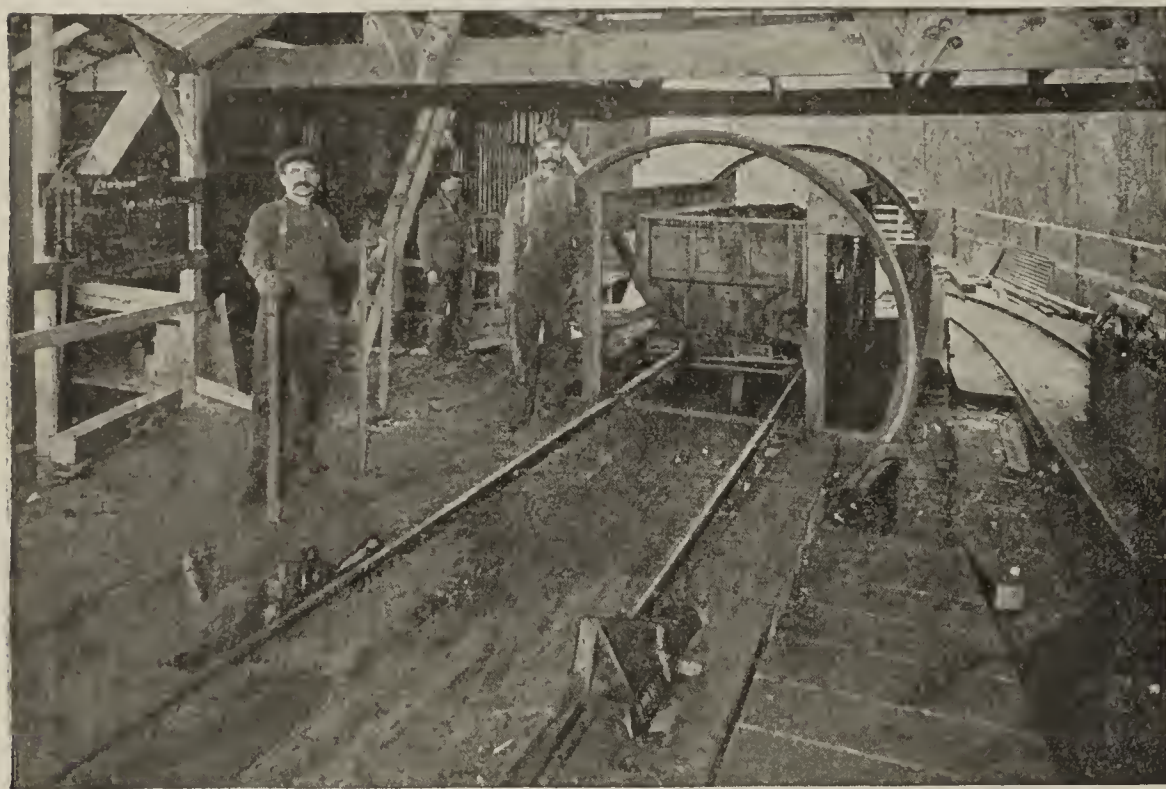
Trial of Cement Companies in Northwest

A demurrer to the indictment charging them with combination in restraint of trade was overruled by Judge Wolverton in the federal court at Portland, recently, in the case of the Government against Oregon

and Washington cement companies. When the California members of the so-called combine pleaded guilty last April and paid fines amounting to \$10,000, the Northwestern companies decided to fight. They are: The Olympic Portland Cement Company, of Bellingham, the Superior Portland Cement Company of Concrete, Wash., the Washington Portland Cement Company of Concrete, and the Oregon Portland Cement Company of Oswego, Ore. The cases are the outgrowth of charges made when directors and officials of the Oregon Portland Cement Company had a disagreement. It was charged that the cement companies had an agreement whereby each agreed to handle specified territory and maintain fixed prices.

Dredge for Sale

The Reliance Equipment Company, Mobile, Ala., advise us they have a 20-inch suction dredge for sale. Steel hull, 225 feet long, 20-inch Morris pump.



Typical Installation of Link-Belt Rotary Dump, Issaquah & Superior Coal Mining Company

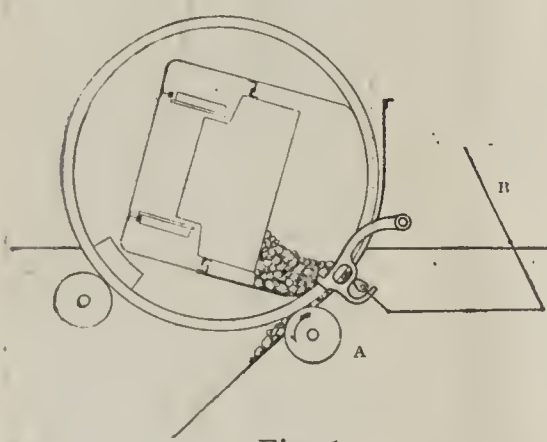


Fig. 1

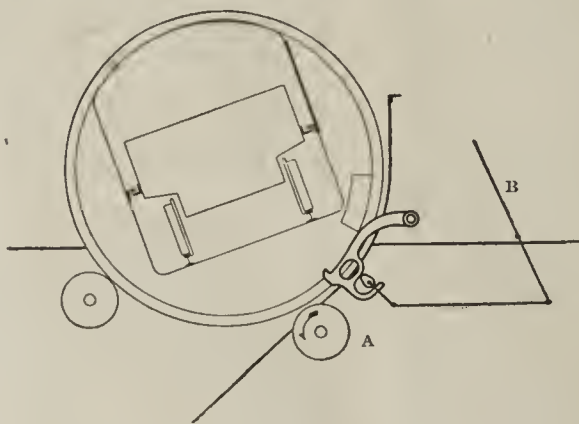


Fig. 2

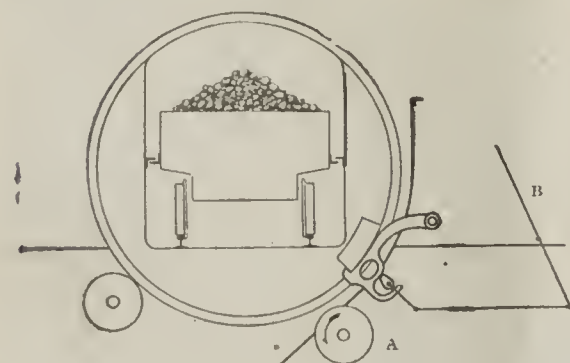


Fig. 3

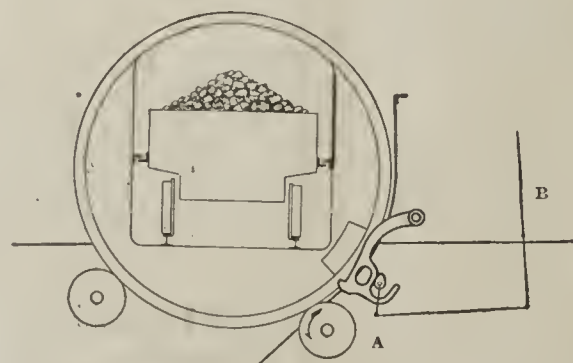


Fig. 4

Rotary Mine Car Dump

For Use in Dumping Rock Cars in Cement Plants, Quarries, Etc., for Large or Small Capacity (Gravity or Power Driven).

The Link Belt Company, Thirty-ninth and Stewart avenue, Chicago, Ill., have just issued Bulletin No. 214, describing very completely their Rotary Mine Car Dump which can be used in dumping the rock cars in cement plants, quarries, etc. The illustrations herewith show their power-operated rotary dump in operation in coal tipples and coal mines, where it has been used with the greatest success.

Lever "B," moved by the attendant, operates an eccentric block throwing out the automatic stop, at the same time lowering the rings of the dump onto the constantly rotating trunnions "A." Lever "B" is immediately released by the operator after the car latch is tripped and the dump makes a complete revolution, as shown in figures 1, 2 and 4, turning the car over, pouring the coal out against a curved chute and returning to original position, as shown in figure 3, coming against the automatic stop in such a way that the large rings of the dump are but a fraction of an inch away from the rotating trunnions "A." The operation is very simple. The operator trips the dump and a complete cycle is made without further attention.

Figures 1, 2, 3 and 4 show the power-driven single compartment rotary dump made for single car, or cars in tandem. The power is received from motor, engine or other means by shaft "A," which rotates continuously. The entering load operates the car stops as previously described on the three-compartment Dump.

Repairless Roofs



Walter Concrete Roofing Tiles are going on thousands of roofs whose owners are tired of repair costs. They are buying Walter Concrete Roofing Tiles to stop those expenses. They want a roofing that does not crack or leak. One that will last long after other roofings would have worn out. They find these advantages in Walter Concrete Roofing Tile.

Walter "Concretile"

No other roofing at a moderate price looks so beautiful. Rich, permanent colors that last. Evenly made tile that lay smoothly on the roof. Fire protection, too, no danger from sparks or flying embers—less fire insurance. These are reasons why so many thousands of home owners are demanding Walter Concrete Roofing Tile.

We sell you complete equipment for starting the business. You can add to your equipment as your business grows. We don't sell territory, but we establish only one plant in a locality. We help you get started. We make sure that you turn out a first-class product and we help you create a market for it. Send today for our booklet on the manufacture of Walter Concretile.

Walter Concrete Machinery Co.
418 Saks Bldg., Indianapolis, Indiana

The Multiplex Double Stripper Block Machine makes two Hollow Plain or Rock Faced Block of Wet Mixture at ONE OPERATION



Here is a machine that cuts down the cost of making your building block. In making plain faced block the machine handles a wet mixture and stripping the block out it trowels the sides. The wet mixture compacted under pressure from *both top and bottom*, produces a strong waterproof block which is easily cured. A 150-lb. man on the end of the lever will exert a 40-ton pressure on the block. Two men will make from 700 to 800 blocks per day on this machine.

Write for our latest printed matter explaining the operation of this labor-saving machine in detail

Write for catalog No. 10 and mention Cement News
The Multiplex Concrete Machinery Co., Elmore, Ohio

Same Machine Makes Chimney Block

The Multiplex Stripper may be equipped for manufacturing chimney block as well as building block. Note the flue block shown here with the round smoke chamber in the center, the ventilating chambers in the corners and the tongue and groove joints insuring rigid construction. There is money in the manufacture of chimney blocks alone.





Sprague Electric Company's New Reinforced Concrete Building

New Reinforced Concrete Building for the Sprague Electric Works

The building outlook for the present year in the city of Bloomfield, N. J., and the surrounding towns is very encouraging. Many important projects are under way, not the least of which is the new reinforced concrete machine shop that is being erected for the Sprague Electric Works by John W. Ferguson Co. of Paterson, N. J.

The main building, now rapidly nearing completion, is of reinforced concrete, 75 by 550 feet, with an ell 75 by 119 feet, six stories in height, the walls of which are faced with brick.

In erecting this large building the contractor used a center tower and two side towers. These latter were connected, as shown in the illustration, with the main tower by a Ransome chute.

Sand and gravel were brought to the job by Pierce-Arrow trucks. A gravel incline was erected to lead to the point over the mixers at the foot of the main tower. Here the sand and gravel were dumped through a grated floor into separating bins, thence passing to the mixer, while the cement was brought to this point on industrial cars.

A Modern Rock Crushing Plant for Paving Contractors

John A. McGarry Company, the well known paving contractors of Chicago, have the contract for repaving Irving Park boulevard, Chicago. This important thoroughfare formerly was paved with granite blocks, which it was desired to crush for use in the new pavement.

The company had an Aurora crusher, elevator and screens, with homemade bins, but its capacity was not sufficient for the job. A second Aurora crusher, therefore, was purchased from the Western Wheeled Scraper Company, Aurora, Ill., and the two were installed by Superintendent B. D. Ridenbaugh on some vacant ground off the boulevard, "hitched tandem," so that the second crusher would handle the tailings from the first machine. It is a most ingenious arrangement and wonderfully successful.

The granite blocks are hauled to the crusher in large Streich dump wagons. The wagons are dumped into the crushers on one side and then driven around to the other, where they load up with crushed stone for the return trip. The conditions which have made it possible to carry a load both going and coming should result in a substantial profit for the contracting company.

Observe
Wagons
Loading
with
Crushed
Stone
After
Having
Delivered
Paving
Blocks
to Be
Crushed



Aurora
Stone
Crushers
"Hitched
Tandem"
in
Chicago,
So That
One Takes
the Tailings
of the
Other.

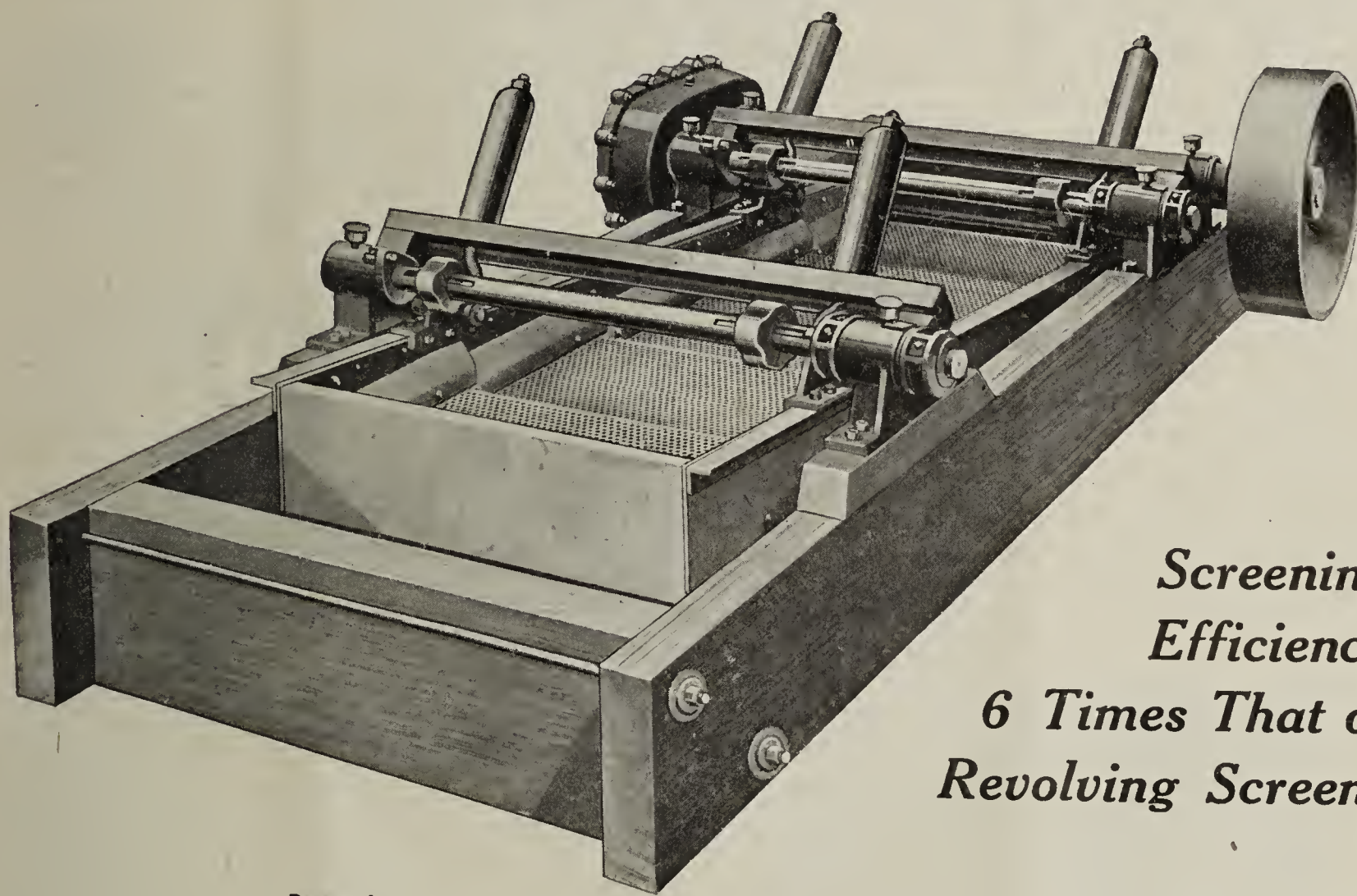
SYMONS

Pulsating Screens

FOR SCREENING ROCK SAND OR GRAVEL

COST LESS THAN REVOLVING SCREENS

Occupies one half the floor space.
Screen surface easily replaced.
Small amount of power required.
Greater screening area.
Snappy motion eliminates blinding.



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Efficiency
6 Times That of
Revolving Screens*

Patented.

We guarantee quick shipment. Tell us what you want to screen and we'll tell you what you need.

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(INC.)

CHICAGO HEIGHTS, ILLINOIS

Notes of Interest from the Cement Plants

Acme Cement Co. Case in Court

Charging a breach of trust, three stockholders of the Acme Cement Corporation yesterday started proceedings in the Federal Court to oust from a board of voting trustees three officers of the company, who are alleged to be preventing the sale of the concern, as well as two other trustees. The court is also asked to invalidate a voting trust agreement which gives the officers control over the company's affairs.

The stockholders desire the sale of the corporation, but their moves are blocked by the three officers for their own personal advantages, it is alleged.

The three stockholders asking the court to interfere in the matter and compel the voting trustees to deliver to holders of voting trust certificates the shares of stock that the certificates represent are: James F. Baldwin, of Manchester, N. H.; Mardie L. Story, of Goffstown, N. J., and Luther C. Baldwin, of Providence, R. I.

The defendants named in the bill are: James Shand, of Lancaster; William F. Beyer, of Lancaster; John J. Matheson, of New Jersey; Edwin C. Willets, of New Jersey, and George H. Hedge, of Massachusetts.

The Acme Cement Corporation is the successor of the Seaboard Portland Cement Company, which began the building of a concern on the Hudson River near Alsen, N. Y., but abandoned the project because of financial difficulties. P. T. Watt, acting for the stockholders, bought the concern, and later out of it grew the present corporation. The capital stock was issued to Watt, who distributed it among the subscribers. The shares later were deposited under a voting trustee agreement, and in exchange for their shares, the stockholders were given voting trust certificates.

Following the resignation of Mr. Watt in 1916, the first three named defendants, it is alleged, conspired with fraudulent intent to obtain control of the corporation for their own private gain. Through alleged misrepresentations concerning negotiations for an alleged loan with a bank, these men, it is charged, succeeded in having Schand and Beyer elected to the board of voting trustees in place of two others who resigned. This resulted in Beyer, Schand and Matheson constituting a majority of the board, and it is charged they so conducted their office as to be guilty of breach of trust.—[Philadelphia Press.]

Stockholders of the Santa Cruz Portland Cement Company of San Francisco have received a stock dividend of 13 per cent, certificates having been mailed. This dividend, which is announced as a special disbursement, depletes the treasury of all unissued authorized stock, amounting to a little more than 5,700 shares. The dividend was ordered paid to stockholders of record July 14.

Charles F. Lewis has filed suit against the Lehigh Portland Cement Company, whose plant is at Mitchell, Ind. He alleges the defendant company has made a stream running through his farm unfit for cattle to drink.

Between fifteen and twenty-five employes of the Portland Cement Company of Utah went on strike recently when the night shift was to go to work.

The night shift, when it went off duty at 7 o'clock in the morning, presented demands to the company asking that the hours of labor be decreased. Under the present system the day shift at the plant works eleven hours and the night shift thirteen hours, in order to keep the plant going twenty-four hours a day.

The night shift and a number of the day shift demanded that the working hours be divided into three shifts of eight hours each. The company refused to comply with the demands of the workmen and as a result the plant was not fully manned when the night shift reported for work.

During the evening, however, the owners of the plant were able to secure enough men to run all departments. It was said at the offices of the company that the full quota of men were at work, but that the work was slow on account of a number being "green hands."

Mr. George S. Bartlett of Milwaukee has joined the sales force of the Universal Portland Cement Company. Mr. Bartlett has been identified with the manufacture and sale of Portland cement for a great many years and has a very wide acquaintance among cement men the country over.

The Missouri Portland Cement Company of St. Louis, Mo., has succeeded the Union Sand and Material Company in the cement manufacturing business. The same brands, Red Wing and K. C., will be retained and the broad policy of the former company continued.

Approximately 150 members of the Portland (Ore.) Chamber of Commerce and of the Progressive Business Men's Club visited the big plant of the Oregon Portland Cement Company, located on the banks of the Willamette River at Oswego, Ore., recently and studied the various mechanical processes required in the making of cement.

Under the guidance of J. E. Moore, assistant sales manager; F. C. Newlands, superintendent; J. R. MacDonald, Hugh Elliott, foreman; M. J. Ballard, Carl Horn, M. V. Wellman and other representatives of the cement company the visitors followed the raw material from its introduction to the machinery of the plant through each of the 11 buildings to the railroad cars where the finished product is started for the markets.

The entire property of the company embraces 43 acres and cost in the neighborhood of \$1,500,000, including the plant and the quarries. The daily output is 1,100 barrels and between 30 and 40 men are employed.

The Portland business men had their first hints on cement manufacture at the crushers where the two grades of rock are crushed and then conveyed on wide belts and dropped into large rock bins. From the bins the material is sent to what is known as the raw grind building where it is ground under a wet process which renders it slurry. Then the material is pumped across the yards and passed through a kiln 210 feet long which is the oil-burner type and it produces temperature of 2400 degrees at the extreme end, a heat that transforms the material into clinker.

Plant Is Extensive

In this state it is sent into storage and then into what is known as the finish grind. After it has passed through two mills it is turned out as cement ready for the tall storage towers and the packing rooms, where it is prepared for shipment.

Among the auxiliary buildings on the company property are the offices, the carpenter, machine and blacksmith shops and the testing laboratories where the cement is examined as to standard. The quality of Oswego is said to be even above standard, its tensile strength being 30 or 40 per cent more than required.

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No. 10

Rapid method of loading and hauling material at the yards of the Superior Sand and Gravel Company, Lima, Ohio. With the loading tank and the dump body the standing time of the motor truck is cut to a minimum.



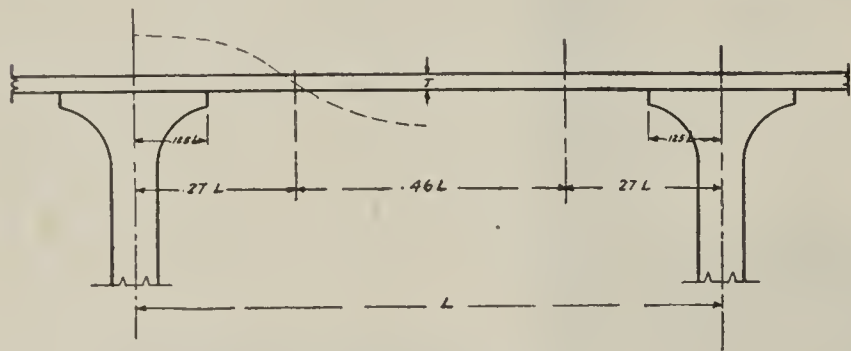
Computation for Concrete Slabs in Textile Mill Design

Ever since concrete came into such extensive use in building construction, especially for textile mills, opinion has been divided as to proper design. Probably no class of machinery has a greater tendency to increase building vibration than the looms used in textile manufacture, and when the additional features of unusual headroom and maximum light are demanded, the design of the building necessitates careful consideration.

Extensive tests were made by the John W. Ferguson Co. of Paterson, N. J., before the building of the Botany Worsted Mills at Passaic, N. J., were begun.

This building was built for a live floor load of 150 lbs per square foot. It was a five-story building, each story measuring 16 ft. in height, with the exception of the top, which is 17 ft., and the basement, 9 ft. 6 in. To obtain maximum head height the floor slab was reduced to a minimum. An 8-ft. flat slab was decided upon. It is supported by an 8-ft. octagonal capital on the columns in addition to the regular column capital. This reduces the span of the eight-inch section between columns and takes up a large share of the vibration of the machinery, at the same time assisting in taking care of the high compressive stresses which exist near the columns under load.

From the tests, the following computations for concrete slabs were evolved. This was based upon the formula for a suspended section and is in keeping with tests made upon buildings under the usual construction conditions. The diameter of the column capital used in the formula was assumed as 0.25 of the long span. This would practically be a mean between the



Typical Floor Section.

8-ft. octagonal capital and the 5-ft. column capital proper. The point of inflection was assumed as 0.27 of the long span from the center of the column. This point of inflection was determined from the tests of buildings under load where extensometer readings were made.

The bending moments for the suspended section and around the edge of the capital are figured as shown.

In this computation,
 W = total load per square foot = 150 lb. + static load.
 L = long side c to c of column = 25 ft.

L' = short side c to c of column = 23 ft.

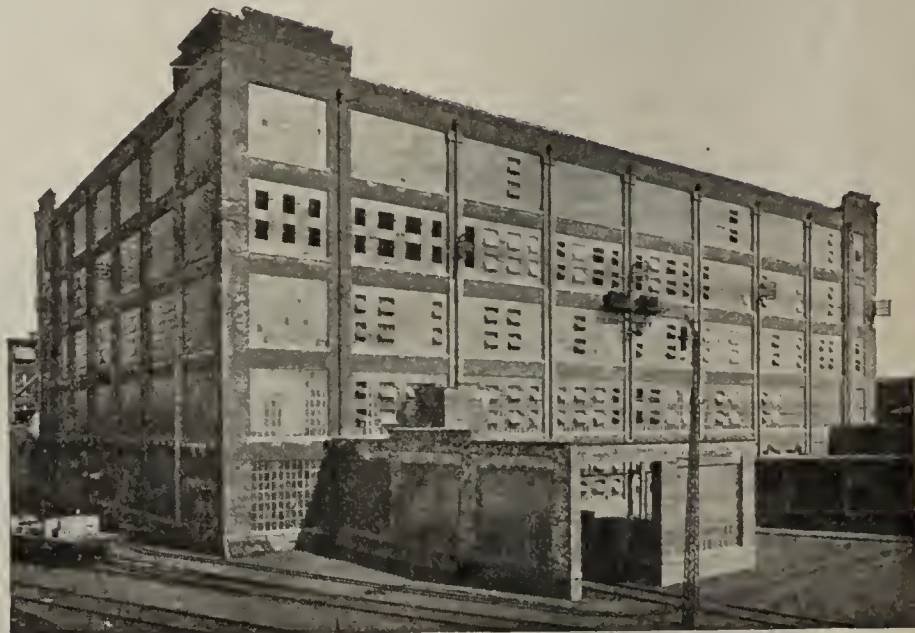
Diameter of capital = .25L.

Suspended section = .46L.

For the suspended section,

$$M = \frac{WL^2}{12} = \frac{W(.46L \times .46L) \times 12}{12} = .2116 WL^2 \text{ inch lbs.}$$

Around the capital head,



Main Building, Botany Worsted Mills,
Passaic, N. Y.



Interior of Botany Worsted Mill.

$$M = W(\text{area panel} - \text{area Inf. Cir.}) \times \text{distance to capital edge.}$$

$$+ W(\text{area Inf. Cir.} - \text{area cap}) \times \frac{1}{2} \text{ distance to capital edge.}$$

$$M = W[LL' - \pi(.27L)^2] \times .145L + W[\pi(.27L)^2 - \pi(.125L)^2 \times .0725L].$$

$$= W(LL' - .23L^2) \times .145L + W(.18L^2 \times .0725L).$$

$$= (LL' - .23L^2) \times .145L + .013WL^3.$$

$$= WL^2(.145L' - .02L).$$

For a square panel $L = L'$, then,

$$M = WL^2(.145L - .02L).$$

$$= WL^2 \times .125L.$$

$$= .125WL^3 = \frac{WL^3}{8} \text{ foot pounds.}$$

$$\frac{WL^3}{8} \times 12 = \frac{3}{2} WL^3 \text{ inch pounds.}$$

Why Some Road Builders Fail

"There is the road builder who assures you that all cement is made of the same kind of material, and that, barring dampness, one cement is as good as another," says Mr. George A. Ralph, consulting engineer, in "The Bulletin," published by the Affiliated Engineering Societies of Minnesota.

"No idea can be more erroneous. There is a vast difference in the binding qualities of the various grades of cement, all of which has been the subject of very careful study. It is now possible by testing to determine in advance the character of the cement employed. Many concrete failures are directly traceable to the builder who insists that all concrete is the same.

"Then there is the builder who is careless in the selection of sand and gravel. He has the opinion that ordinary bank run gravel will make satisfactory concrete. As a matter of fact there is scarcely any bank run gravel that will give satisfactory results, particularly in positions where there is great stress upon the concrete. All sand and gravel should be carefully screened and mixed in proper proportion after being screened if satisfactory results are to be obtained. Both should be examined most carefully for the presence of earth, clay, or vegetable matter, either of which has a most deleterious effect upon the concrete, and wherever it is present the material should be carefully watched.

"There is still another class of builders who may be careful in the selection of sand and gravel and cement, but who cannot realize that pure water is essential to satisfactory results. Many concrete bridges and culverts are made today from material mixed with water taken from a near-by open ditch. Ditch water is invariably loaded with silt and organic matter, and good results cannot be reasonably expected with water of this kind. Clean, pure water is as essential as clean sand and cement. But with all the care possible in the selection of raw materials satisfactory results are quite often not forthcoming. On the contrary lamentable failures are everywhere visible."

Concrete Roads Durable

Cost of maintaining all the highways in Wayne County, Mich., outside of the city of Detroit, was reduced to \$23,393 last year, representing a saving of \$7,140 over the previous year, according to the eighth annual report of the board of county commissioners. This reduction is credited to the replacement of certain macadam roads with concrete pavement.

Ample justification for the adoption of the concrete road as the standard type of construction is found by the commissioners in the fact that there are over 100 miles of concrete road in Wayne county, some of it in its sixth year of service, without the semblance of a rut and without a single twenty-five foot section having been taken up and replaced since the county has been building and developing this type of road. It is comparatively low in first cost; it is free from dust; it furnishes good traction for all types of vehicles; it is not slippery; it is durable; it does not require excessive yearly maintenance charges; it is usable 365 days in the year irrespective of weather.

As a result of the success of the Wayne County roads the city of Detroit built or let contracts for 139,107 square yards of concrete streets previous to 1913 and laid eight similar streets in that year aggregating 73,302 square yards. Wyandotte, Mich.; Oakland County, adjoining Wayne, and Windsor and Walkerville, Ontario, have all built or contracted for a considerable yardage of concrete streets and roads. It is estimated that \$25,000,000 worth of the type of construction will be built this year.

The Contractor and His Help

F. Ford

Some successful contractors are not mechanics at all. Their success is due to general business ability and the power to choose men. These contractors would in all probability be still more successful if they were good mechanics as well. On the other hand some first-class mechanics have failed as contractors because of poor business ability and poor judgment in choosing men. A first class business man who is a keen judge of human nature is much more likely to make a success of contracting than the expert mechanic who is deficient in the other qualities.

Without a good grasp of general business principles hardly any man can hope for large success as a contractor. But quite as essential is the ability to choose men. No big business depends on any one man but on many. No business can grow to large proportions while any one man has to give personal attention to every detail. The secret of big business is the marshalling of men who will take and bear their share of responsibility.

What principles guide these contractors who are successful in their choice of men? I doubt if any one of them could tell off-hand. Such contractors do not consciously know what principles guide them. They would have to stop and think it out before it would be clear to themselves. They are guided, for the most part subconsciously, by experience, observation and intuition. Experience comes only with years. Observation is a talent that differs widely in men. Intuition is something that cannot be taught—it is part of the man.

The writer believes that this whole matter of choosing men is an art and can never be laid down as an exact science, there are some few principles that may be generally helpful. In choosing any class of men for any class of work the first and foremost thing to be sought is reliability. Nothing else can take its place. Can a man be depended on? That is the main question. All the ability in the world is useless unless accompanied by reliability.

Concrete Sewerage System

Mt. Horeb claims the distinction of being the first village in Wisconsin to have its entire sewerage system constructed of cement concrete. The sewer pipe was manufactured by the Waupaca Sand & Gravel Company, Waupaca, Wis., and was composed entirely of cement and sand. The specifications followed for its manufacture were almost identical with those prepared by the engineering department of Kansas City, Mo.

Some of the advantages considered in selecting this pipe were: A more perfect joint, a smooth and uniform interior surface which would cause the least deposit, and about 14 per cent greater carrying capacity than vitrified pipe.

Some of the disadvantages of the use of this pipe as discovered during construction are its weight as a drawback in handling, slightly larger and deeper trenches, greater porosity and difficulty in cutting to an exact line or shape at terminal points or in manholes. However, on the whole we considered the advantages were greater than the disadvantages.

The manholes were all built of cement blocks, cast in an arc of a circle. These blocks, from the contractor's standpoint at least, were an improvement over brick, considering cost and ease of building the manholes. They should also prove to be economical from the standpoint of durability, but only time will prove whether they will disintegrate faster than brick.

perintendent upon a very complete blank furnished for that purpose. This blank covers everything required in the way of "plant" from band saws to vertical engines, of small tools from anvils to wrenches, and of stationery, from pay envelopes to rubber stamps. It is the business of the "yard" to keep its stock complete in each of the items so that shipment may be made without delay.

Following the requirements of the plant layout, offices and storehouses were shipped from the contractor's yard, each building being made of standard sections 15 ft. wide in 10-ft. lengths.

As soon as the cement schedule was made out, the order was placed, the storehouse was filled in advance of requirements, continuous shipments from the cement mill were maintained and arrangements made with a local dealer so that his supply could be drawn upon in case of emergency.

All scheduled form lumber cut to dimensions was turned out by a local mill, delivered by truck to the job and piled separately, according to size, and ready to use.

The Progress Chart, which graphically represents the dates and limits, and serves as a basis for recording progress, is reproduced herewith. Three blueprints of it are sent to the job, one for the superintendent, one for the routing clerk and a third to be brought up to date weekly and sent to the Boston office. Another copy is kept on the board in the Boston office and is brought up to date weekly from the copy sent in by the job.

On the blank blueprint each item of work is represented by a wide white line. When the work is started it is recorded on the sheet by drawing a yellow line over the upper part of the heavy horizontal line. The length of the yellow line is made proportional to the amount of work done on that item, the entire heavy line representing volume rather than time, although it spans the period between the scheduled beginning and ending. It is, therefore, evident that the ratio of the length of yellow line to the total length of the heavy line represents the proportion of that particular item of work which has been completed.

When the work does not start on time a red line is drawn over the lower half of the wide line and is continued to the date when the work stops. Then the yellow line is begun in its proper place. The red line, therefore, shows at a glance just how far behind the work is upon a given item.

Each week a piece of string is stretched vertically across the chart from the current date shown at the top of the sheet. If, at any time, the yellow lines extend beyond the string it indicates that the job is ahead of schedule on that particular item.

Thus, the progress of the entire job is visually shown from day to day on the bulletin board in the home office.

New Cement Plant in Guatemala

A new cement mill, with a capacity of from 50,000 to 100,000 barrels of cement per year, has just been opened about one mile from Guatemala City by American interests, acting under a special concession of the Guatemalan government. The plant has been under construction for two years, and involves not only the mill itself, but two miles of railway connecting with the port. Practically all the machinery was manufactured in the United States. The new company is restricted under its franchise to a maximum charge of \$4 per barrel for its product. The managers state that they will be able to manufacture cement at a cost of \$1.25 per barrel.

Slag Combined With Concrete

Investigations and Test Are Made to Determine Availability

Investigations and tests made to determine the availability of slag as an aggregate for concrete were described by Sanford E. Thompson, consulting engineer, Boston, Mass., in a paper presented at the thirteenth annual convention of the American Concrete institute. The investigation by Mr. Thompson covered the following:

The use of slag for plain and for reinforced concrete.

The relative value of slag versus gravel for building construction.

The relative characteristics of slag made from different processes.

The relative value of the same slag under different conditions of age, size and porosity.

The strength of slag concrete with the permissible proportions and stresses to adopt.

The durability of slag concrete.

To properly treat these various questions, several series of tests were undertaken. The data derived from these tests and from a study of previous investigations are summarized in the paper as follows:

The strength of concrete made with slag, such as is obtainable commercially in eastern and northern Ohio, was on the average about 50 per cent higher at the age of 28 days than gravel concrete made with first-class materials.

Using the same proportions by volume as for gravel concrete, about 15 per cent more cement on the average was required per cubic yard for slag concrete than for gravel concrete of the same proportions.

No authentic cases of deterioration of slag concrete made with Portland cement or of rusting of steel imbedded in such concrete have been discovered.

Porous slag produced a concrete of substantially the same strength at 28 days as dense slag. At later ages, the dense slag is probably stronger.

Slag made by different processes and under different conditions showed no marked difference in strength and other characteristics.

An extremely hard, dense, acid slag did not produce a concrete of greater strength than porous, basic slag on a 28-day test.

The weight of the slag concrete tested averaged about 6 per cent lighter than an average gravel concrete. On the other hand, very dense acid slag concrete was heavier than gravel concrete.

Granulated slag sand produced a mortar of inferior tensile strength on short-time tests.

Cement Man Guest at Company Banquet

C. E. Ulrickson, president of the Trinity Portland Cement Company, Dallas, Texas, was host at a supper given at the Southland hotel in honor of Gerard H. Doerner, assistant traffic manager of the company, who enlisted in the United States navy.

Doerner, who has been with the Trinity company for the past several years, enlisted as a yeoman several months ago but was ordered to remain in Dallas until called to the colors. He received instructions Monday to proceed to San Francisco.

The supper Tuesday night was in the form of a surprise. With fifteen members of the office force of the Trinity company present young Doerner was given an enthusiastic sendoff.

CEMENT AND ENGINEERING NEWS

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Advertising copy or changes in ads. must be in this office by the 25th of each month, as hereafter our magazine will appear on the 5th of the following month

Advertising Rates Sent on Application

JOHN F. WALDRON

Advertising Manager

CHICAGO, OCTOBER, 1917

The Cement Machinery and Building Equipment Show

The greatest of industrial exhibitions will be held under the auspices of the National Exhibition Company at the Coliseum in Chicago, February 6 to 13, 1918.

The Cement Machinery and Building Equipment Show succeeds the Cement Show of former years. It will be a cement show, a good roads show, a clay products show, a wood products show—all combined in the interests of contractors, engineers, cement products manufacturers and architects, and will be the greatest industrial exhibition of its kind ever held.

Equipment, materials and supplies will be exhibited for the investigation of those interested in contracting and engineering in all its phases. The wide scope of the exhibition will interest thousands who were not interested in the exhibition of the past.

The National Exhibition Company is a new organization. It has purchased all of the show fixtures and equipment of its predecessor, the Cement Products Exhibition Company, and has the assurance of its good will.

Mr. L. F. Mead, to whom much of the success of the last several Cement Shows has been attributed, has been selected to manage the new undertaking. The coming show will be managed on the same general plan as the former cement shows with such minor changes as experience dictates.

Mr. Mead also announced that many of the applications for exhibit space already received promise interesting exhibits that were never seen at the former shows. It would be difficult indeed to over-estimate the value of this great exhibition to these allied industries.

Chief of Portland Cement Association Dies Suddenly

On Saturday, September 8, James P. Beck died at the Presbyterian Hospital, Chicago. At the time of his death he was general manager of the Portland Cement Association, with headquarters at 111 West Washington street, Chicago. Mr. Beck was a little past 31 years of age, having been born January 27, 1886, at Odell, Ill.

\$1,000,000 for Concrete Roads in Washington County Mississippi

What is believed to be the largest single contract for concrete public highways by one Southern county will be let next month by the Highway Commissioners of Washington county, Mississippi. The contract will call for the construction of approximately 160 miles of nine-foot concrete roads, with a 24-foot roadbed. The contract provides for laying approximately 830,000 square yards of metal surface, to be built of concrete. The grading will be done by the county forces, and will amount to a little over 1,000,000 cubic yards. The sand and gravel, of excellent grade, will be obtained from extensive beds in the Mississippi River at Greenville. The work of grading the roadbed is well under way, and will be pushed through to completion as rapidly as possible. It is estimated the entire work, including the grading and laying the metal surface, will be completed by December 1, 1919.

The construction of these permanently paved highways will, in addition to serving the county as a whole, provide the Washington county link in the Delta Highway, now under construction from Memphis, Tenn., through the Delta section of Mississippi to Jackson, Miss., a distance of approximately 290 miles.

The rapidity with which the sentiment for permanently paved highways in Washington county crystallized into a strong, permanent and effective working organization is evidenced by the fact that on July 5, 1915, the Greenville Chamber of Commerce held the first meeting to discuss good roads. At this meeting a good-roads committee was appointed to take charge of the movement. The services of a Government expert highway engineer was immediately secured, surveys and estimates were made, and after the good-roads committee had investigated some 42 different types of road-building materials, these investigations extending from Maine to California, an election was ordered for June 1, 1916, to vote upon the issuance of \$1,000,000 of 5 per cent 25-year serial bonds to provide funds with which to construct the roads. The bond issue carried by about 5 to 1. On June 5, 1916, a highway commission was appointed, consisting of E. W. Woods of Leland, P. L. Mann of Glen Allen and W. P. Kretschmar of Greenville, all of this county, to take charge of the construction of the highways. On June 23, 1916, the Highway Commissioners appointed J. S. Allen of Greenville chief highway engineer, who immediately commenced active work. The bonds were sold in November last at 104.24, resulting in a handsome premium on the sale.

It is thus shown that within one year from the date of holding the first meeting to discuss, informally, the subject of good roads, reconnaissance surveys and estimates of the work had been made, a \$1,000,000 bond issue authorized by a direct vote of the people, a highway commission appointed, engineering forces organized and work on the highways had actually commenced. We claim this record is unequalled by any county in any State in the Union.

Freight Shipments

Shortage of cars and scarcity of ships make it imperative that something be done by shippers with the idea of getting the most freight in the least space and of loading cars even beyond stipulated capacity. The Clinchfield Portland Cement Corporation of Kingsport, Tenn., for instance, through judicious management in arranging shipments and loading its cars, was able to save space to the equivalent of 36 cars in one month. At this rate this one concern would be the means of releasing for other service over 400 cars in a single year.

Small Circular Concrete Bins Used for Storage of Cement

Universal Mill at Duluth Has New Pockets Designed for Hydrostatic Pressure of 25 Pounds per Square Foot.



New Cement Storage Bin Built of Reinforced Concrete.

Reinforced-concrete bins for the storage of cement, similar in design to the more common grain-elevator bin, have just been completed for the Duluth mill of the Universal Portland Cement Co. This type was adopted after studies showed that small bins had greater flexibility of operation and that the circular design was more economical than the rectangular.

The structure as built consists of 27 circular bins, each 33 ft. in diameter by 50 ft. high, with two packing rooms having car sheds, or canopies, a loading platform on each side, a superstructure for the conveying machinery to the bins, and tunnels underneath for conveying cement from bins to packing rooms.

The bins are grouped in three rows and are separated into two batteries by one of the packing rooms, one battery of 18 and one of 9 bins. Fourteen interspaces formed by the meeting of outer wall surfaces are also utilized for storage. The 27 circular bins have a capacity of 10,300 bbl. each, while the 14 interspace bins have a capacity of 2200 bbl. each, thus making a total storage capacity slightly in excess of the desired 300,000 barrels.

The bin walls have a uniform thickness of 9 in. except where they intersect, at which point they are 12 in. thick. Angles at the intersection are filled in to a distance of 5 ft. on each side of the center line. The horizontal reinforcement consists of $\frac{3}{4}$ -in. rods for the first 25 ft. from the foundations, $\frac{5}{8}$ -in. rods for the next 10 ft. and $\frac{1}{2}$ -in. rods for the remaining 15 ft. Three rods are used to complete the circle, rods being lapped 4 ft. at each splice. All laps are staggered. The $\frac{3}{4}$ -in. rods are spaced 4 in. apart for the first 10 ft. of the bin walls, 5 in. apart for the next 10 ft. and 6 in. for the next 5 ft.; the $\frac{5}{8}$ -in. rods are spaced 5 in. apart for the first 5 ft. and 6 in. for the next 5 ft.; the $\frac{1}{2}$ -in. rods are spaced 5 in. apart for the first 5 ft. and 8 in. for the remaining 10 ft. The vertical reinforcement consists of $\frac{1}{2}$ -in. rods spaced 2 ft. 6 in. apart—standard practice being followed closely.

As shown in the drawing, the bins are founded on footing courses, which was more economical than a slab foundation, but not as satisfactory in stability. In future work, unless the ground is of very solid formation, it is probable that a continuous slab footing will be used.

Experiments Determine Design Pressures

As a result of experiments, the company concluded that, although cement maintains a more or less stable angle of repose, conditions arise to prevent a uniform flowing action during discharge or withdrawal from the

bottom of the bin, and the cement is likely to remain or hang in a vertical position, or possibly even "under-cut." It was further concluded from these experiments that a wall designed to withstand a hydrostatic pressure of 20 lb. per sq. ft. is ample to take care of any likely variations of pressure that will occur in bins of the usual dimensions and, say, of 40,000-bbl. capacity. The design of an earlier stockhouse was based on a hydrostatic pressure of 20 lb. per sq. ft. and no visible sign of overstraining has developed in this structure during the time it has been in operation. However, with circular bins of less diameter and greater height, a design based on a pressure of 25 lb. was deemed advisable, due to the changed conditions.

Operating Equipment Detailed

Tunnels, one of which is beneath the center of each row of bins, are built in conjunction with the foundations. They contain the screw conveyors that move the cement from the bins to the elevators leading to the packing-machine hoppers in the packing rooms. The roofs of the tunnels form a part of the bin floor and have five openings to each bin, through which the cement flows to the screw conveyors. As the tunnel roofs are subjected to the pressure of the overhead cement, they are reinforced with $\frac{5}{8}$ -in. bars spaced 4 in. c. to c. To resist the upward thrust of the ground, the bottom, or floor, of the tunnels is also reinforced.

Spaces between the tunnels and bin foundations are filled in with earth, on which the bin floors are placed, allowance being made for subsequent settlement from the weight of the cement. Surmounting the bins is a double-decked reinforced-concrete superstructure that houses the belt-conveying apparatus and the spouts that distribute the cement to the various bins as it

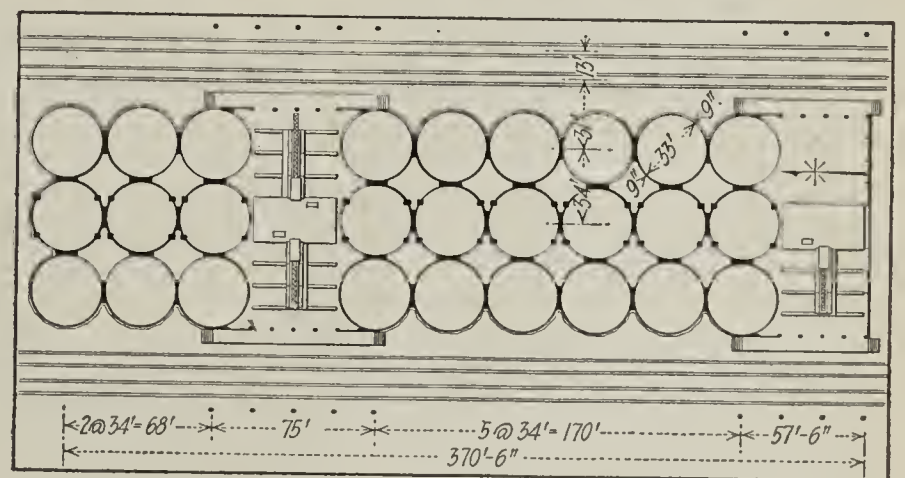


FIG. 1

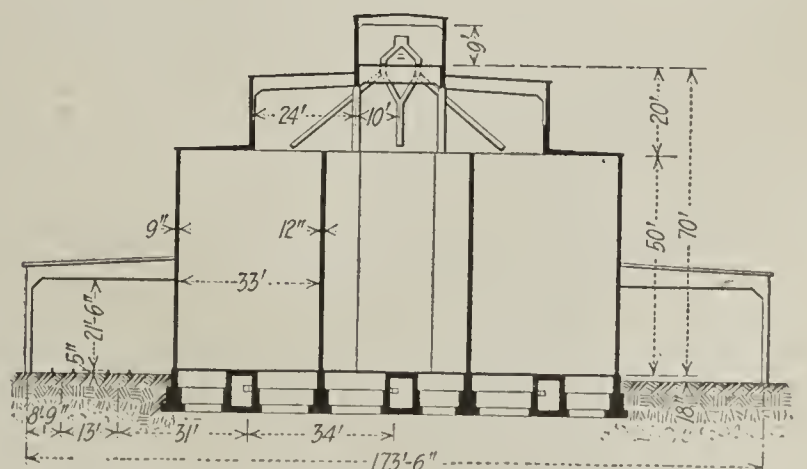


FIG. 2

Details of Layout of Universal Portland Cement Concrete-Storage Bins.

comes from the finishing mill. This design provides a narrow upper deck, or monitor, for the conveyor belt and a broader lower section to give sufficient incline for the spouts to the two outer rows of bins. To relieve the bin walls of some of the dead-load, pilasters were built in conjunction with the walls of the middle row of bins from the foundation to the superstructure.

Over the packing room, the superstructure is carried on reinforced-concrete girders spanning 48 ft. from center to center. As the length of the structure is 388 ft. and the extremes in temperature are considerable, provision for expansion was made at the central packing room by means of sliding joints where the girders rest on the supporting columns. The roof of this building consists of reinforced-concrete slabs, cast in place.

The packing rooms, which house the packing equipment, consisting of automatic packing machines and hoppers, are of the same general layout, except that the one between the bins may receive cement from either side and has two elevators, while the end packing room receives from one side only. Beneath each is a basement containing the driving machinery for the screw conveyors in the tunnels and the cross screw conveyors that carry the cement from any of the tunnel screw conveyors to a bucket elevator, by which it is delivered to the second floor of the packing room.

All conveying machinery in the tunnels, basements and packing rooms is driven by electric motors direct-connected to speed reducers that drive the conveyors at the proper speed. By this method the driving mechanism is simplified and the number of moving parts greatly reduced, thereby lessening the hazard of injury to the operators.

The end packing room has a slanting roof of structural steel covered with cement tile. Should the storage capacity of the plant be increased at a future date, the extension will be built from this packing room; and this type of roof admits of easy alteration.

The stockhouse was designed by the company's own engineering department, which also furnished the specifications and all detail drawings for its erection. It was erected by Haglin-Stahr Co., of Minneapolis.

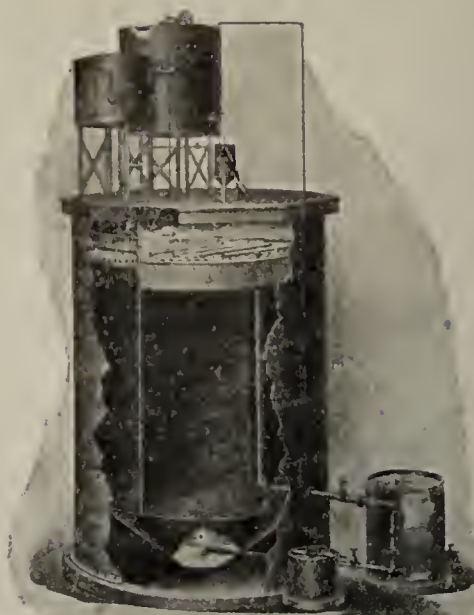
Filtering, Softening and Purifying Systems for Boiler Feed and All Industrial Uses

Softening and Purification renders water both soft and clear through precipitation of lime, magnesia and iron by chemical reaction and the subsequent removal by sedimentation and filtration of the resultant precipitate, together with all other impurities in suspension.

The fundamental features of all designs of systems are—accurate chemical treatment, thorough mixture of reagents with water, accelerated chemical reaction, rapid sedimentation, and perfect clarification.

Design for each installation and performance guarantees are based upon scientific investigation of water supply and uses, supplemented by analysis and treatment of water in own laboratory.

In the We-Fu-Go System (intermittent), manufactured by Wm. B. Scaife & Sons Co., Pittsburg, Pa., definite quantities of water are treated, therefore accuracy of treatment can be maintained and uniform water obtained, regardless of variations in quality of raw water or rate of use. The treating tanks of this system act as storage tanks, consequently there is always a supply of treated water available. This system consists essentially of two or more treating and settling tanks, fitted with mechanical stirring devices operated by power; a small chemical mixing tank with stirring device; means for introducing the reagents into the treating tanks, and a quartz filter of either



Syphon System,
One of Six Types of Continuous Systems.

gravity or pressure type. This system is built for any capacity.

The Syphon System (continuous) is an automatic system not dependent upon moving mechanical devices for reagent introduction. The water enters a receiving tank to which is connected a syphon; into the long leg of which smaller syphons connect from the solution tanks. When the main syphon begins to flow it starts the small syphons, which introduce the reagents during the period of syphon discharge. This system can be arranged to be operated either from the ground or from the top as may be desired.

In addition to this system three other standard continuous systems are manufactured and special systems designed where required.



"We-Fu-Go" System.
Intermittent System.

New Cement Rates Sought By Company

The Pacific Portland Cement Company, of San Francisco, has filed with the Railroad Commission a complaint against Tidewater Southern Railway Company, Southern Pacific Company and the Cement, Tolenas & Tidewater Railroad Company, asking the Commission to fix reasonable and non-discriminatory joint through rates for the transportation of cement from Cement, Solano county, to points on the line of the Tidewater Southern Railway.

The Cement Company asks that these rates do not exceed the existing rates from Cowell to corresponding points on the line of the Tidewater Southern, and it also demands reparation on all shipments of cement from Cement to the points mentioned since February 23 last, to the extent of the difference between the rates that may be fixed by the Commission and the alleged unjust rates charged the cement company.

Grafting Cement and Tree Surgery in France

"Tree surgery" is an art which has been better developed in France than in this country, and it is fortunate that so much attention has been paid to it. For, as a consequence, thousands of fruit and other trees are now flourishing which the Germans, in their lust for destruction, essayed to destroy. When the close pursuit of the French armies gave the Germans insufficient time in which to completely cut down the trees, the vandals cut off a circle of bark around the trunk, well knowing that a few days' exposure to the sun would be sufficient to kill peach, plum, apple, apricot and cherry trees that had been half a century in attaining their productiveness. Fortunately, French arboriculturists were summoned into counsel to face the problem as to how to preserve the trees so mutilated. They were, happily, equal to the task, and proceeded to bind up the wounds like the wounds of a soldier, and thousands of army surgeons and Red Cross ambulance drivers and stretcher-bearers assisted in the work. The circle where the bark had been cut away was first covered with a grafting cement and the entire wound bandaged—often with bandages that had been prepared for human limbs. So great was the number of trees that had to be dressed in this way that the entire available supply of grafting preparation was quickly exhausted. Where the trees had been completely cut or sawn down, the protruding stumps were trimmed and the exudation of the sap was prevented by clay or cement dressings, while branches from the upper portion of the trees which showed signs of life activity were grafted on many of the severed stumps. Today, we learn, these grafts are in full leaf and

blossom. The roots appear to have been entirely saved by this process, and years have been saved in restoring the cut-down orchards of France. "Tree surgery" is no new art, and for several years, particularly in America, the practice of preserving trees that have been injured by disease or accident has been successfully carried out by filling stumps with cement. The protection of several vegetable tissues with wax, tar and other substances has been long used in horticulture and arboriculture. The principles governing the "surgery" of plants are, in many respects, similar to those which appertain to human surgery.

Skilled Operation Saves a Venerable Coffee Tree

This fine old Kentucky coffee tree stands in front of Red Rose Inn on the estate of J. Kearsley Mitchell, Villá Nova, Pa. What is the value of such a tree? Money cannot buy it nor replace it. In preserving a tree with concrete the skillful tree surgeon first removes all decay. After the cavity has been thoroughly cleaned it is carefully disinfected, to kill the disease which produced the decay, called fungus.

In cut No. 1 begins the amazing process of mechanical bracing, which is encased within the filling on the inside of the tree. Every decayed tree is different, requiring many novel mechanical devices.

In cut No. 2 the bark has been traced back to live, healthy tissue. Around the edge is a V-shaped groove to keep water from the cavity. Then starts the filling.

Cut No. 3 shows the filling complete in sections, which allows for the natural sway of the tree. Nature does the rest. Every year will see the new bark growing more and more over the filling.



The Original Floor Sanding Machinery

It was about fifteen years ago that the method of surfacing wood floors by the sanding process was first thought of.

It was while the Natural Science Building of the Leland Stanford University, located near San Francisco, California, was being built. Up to that time all the floor surfacing was done by the hand method of scraping. In fact the floors of the Natural Science Building of this great California University were to be surfaced by the same old process, but an unusual condition arose at that time. The contractor who was to construct the building figured on \$6,000 to cover the floor surfacing. Through an oversight when his bid was placed the item of \$6,000 for the floor surfacing work was not included in the total and in fact was not discovered until it was too late to withdraw his bid.

The contractor went to Mr. J. H. Prugh, who was a practical man in the floor surfacing line and who had a vast amount of experience in doing floor surfacing under contracts on a large scale all over the United States. The contractor employed Mr. Prugh to devise some means whereby the floor surfacing work on the large building that was under construction could be done at a much smaller expense than hand scraping. Mr. Prugh set to work at once to devise some mechanical means for doing the work and after months of planning he decided on constructing a machine with two rolls each 24 inches long and about 8 inches in diameter which would be covered with garnet paper, revolving at a high rate of speed. This would surface the floors more rapidly than scraping by hand. This machine was constructed in a very short time and a 5-hp. electric motor secured for operating it.

While the machine was a rather crude affair it did the work at a cost not to exceed \$2,000, which was about one third of the cost that the contractors had figured on. The floors finished were of Oregon pine, and after the work had been completed it made a beautiful job.

Mr. Prugh's achievement caused much comment all over the United States and a demand quickly sprang up for these machines. Application for patents were made and a company was organized to manufacture and market the new machine. The parties interested in the new company left San Francisco for the east looking for a central location for establishing their factory; and after looking over the grounds at Kansas City and St. Louis, finally decided to locate at Chicago.

They started in a very small way, having rented a small building, but since that time have purchased a large plant and now have a large line of surfacing machines of all kinds and are the largest in this line of business.

The "Big American," which is the original machine this company built, is self propelled, the operator standing on the machine, having full control of guiding it and surfacing the floors either forward or backward at the rate of 35 square feet per minute. The machine is driven with a 5-hp. electric motor which not only operates the machine but drives the sanding drums which revolve in opposite directions at a speed of 600 revolutions per minute. The suction fan picks up all the dust and dirt from the floors and stores it into a sack.

The "Big American" floor surfacing machine will surface as much flooring per day as can be accomplished by from 15 to 20 expert floor scrapers and has an earning capacity of from \$30 to \$50 per day. The

cost of power will vary from \$1.00 to \$1.50 per day, and the cost of garnet paper will not exceed \$1.50 per day. The "Big American" machines are mostly for large work and practically 75 per cent of the work done in the larger cities is done with these machines.

This company also makes a smaller machine for wood floors, called the "American Universal." This machine has a single sanding roll 12 inches wide,



which is driven with a 1-hp. motor by means of a silent high speed chain. It is equipped with a dust collector and in fact is just as complete as the "Big American" machine, only it is not self-propelled. The machine weighs about 350 lbs. and is easily handled from one floor to another. The power for operating the "American Universal" amounts to about 40c per day and the cost of garnet paper from 75c to \$1.00.

One man with an "American Universal" can do as much floor surfacing as from five to six expert floor scrapers.

Some contractors are under the impression that before a sanding machine is used, the floor is scraped by hand; but this is a mistake, as the machine accomplishes the work from start to finish. For the rough cut a coarse grade of garnet paper is used—about a No. 2½, and for the finishing a No. 1.

With the scarcity of labor prevailing at the present time contractors have found this labor-saving device to be a wonderful help for their business, as it not only reduces greatly the cost of their floor surfacing but eliminated the delays and worry of getting capable workmen.

Full information regarding these machines can be secured from The M. L. Schlueter Co., 225 W. Illinois St., Chicago, Ill.

"Link-Belt Electric Hoists"

In this day of labor-saving devices, the electric hoist has come to be one of the most important of such devices. In all of our great factories where machinery is made, electric traveling cranes are used to transfer machinery from tool to tool, thus expediting the work otherwise rendered far more expensive. Every cement mill should have an overhead traveling crane to hoist the broken parts out, or put new parts in their places.

The Link-Belt Company, with its headquarters in Philadelphia, Chicago and Indianapolis, and with sales offices in nearly every one of the large cities of the country, has recently issued a handsomely illustrated catalogue, under the title taken as the caption of this article, and known as Book No. 246. This catalogue is printed on fine paper with fine illustrations of the whole schedule of the Link-Belt electric hoists, and any one interested in such devices can secure a copy of this catalogue free of charge, by writing to one of the above addresses. The value of such machines is now universally recognized and they are certainly worthy of careful investigation by every engineer.

Concreting in Warm Weather

Unless concrete work is properly protected from rapid drying out for a few days after placing, its strength and wearing qualities will be considerably reduced, says a bulletin issued by the Portland Cement Association.

The hardening of concrete is not a drying process. In reality concrete hardens best and most uniformly in the presence of moisture. Water is necessary to complete the chemical changes that take place when the cement and water are combined. Mixtures may have been properly proportioned, the concrete mixed to the right consistency and properly placed, yet if the work is exposed to hot sun and drying winds its strength and hardness will fall below maximum.

The protection which is necessary to the success of concrete work in cold weather is quite generally known, but many persons neglect to apply the necessary protection during the usual concreting season when hot sun and dry wind prevail almost daily.

Generally speaking, the protection that should be given to concrete work during hot, dry weather is about the same for all classes of concrete work. Ways and means of applying it may differ slightly, but all aim to prevent the concrete from drying out.

Pavements in general, which properly includes floors, sidewalks, driveways, etc., expose a relatively large area to the atmosphere than does mass concrete. Thin wall sections have a still greater area exposed to the atmosphere, usually two sides instead of one.

Floors, walks, street and highway pavements may be protected by a very simple means. In very hot weather it is best to stretch canvas on frames over concrete street and highway pavement immediately after the surface has been struck off and floated. Then, when the concrete has hardened enough so it will not be marked or pitted by covering with earth or other water-retaining material, 2 inches of this should be evenly spread over the surface. This covering should be sprinkled often enough each day to keep it always moist. Concrete streets and roads should not be opened to traffic until all possibility of injury has passed—from three to four weeks or more after the last concrete was placed, depending on the weather conditions during that time.

Walls of such structures as concrete silos and water tanks should be protected either by frequent sprinkling or preferably by hanging canvas or burlap over them. The canvas or burlap covering as well as the concrete should be sprinkled often to prevent loss of water from the concrete by evaporation. Sometimes, especially when the temperatures are not extremely high, sprinkling of the concrete alone, if done at sufficiently frequent intervals, gives the desired protection. Concrete pavements are sometimes protected by flooding or ponding. When sufficient water is available this method is certain to produce good results.

Small concrete watering troughs, such as would be used in the ordinary barnyard lot, should be covered with wet hay or straw and the covering be kept wet for several days.

Mass work, such as foundation walls, almost all of which are below ground, heavy abutments and retaining walls do not need the same extreme measures of protection as does work of thinner or exposed section. Leaving forms in place and occasional sprinkling or wetting down of the work for several days will usually give the necessary protection.

Concrete roofs and thin building walls require about the same measures of protection, as both outside and inside surfaces are more or less exposed. Roof slabs should be covered with moist earth or sand, just as protection is given to pavements and floors. Sprinkle

the covering frequently. Keep the concrete moist.

Stucco may be ruined unless protected during hot weather. Walls must be wet down and the sides of the building exposed to sun and wind be covered with canvas to prevent sun and wind from drying out the fresh stucco.

Protection of concrete work in warm weather sometimes involves special attention to the sand and pebbles or broken stone. Sand piles may have been so exposed to sun and wind as to have thoroughly dried out and become heated. This condition should be watched and where a certain quantity of water was determined necessary for a batch of concrete when the sand contained considerable moisture, the quantity of water must be varied as the sand becomes dryer, so as to secure the same consistency of batches throughout.

In very hot weather it is desirable to keep cement in the shade.

Use as cool water as possible to obtain.

Protect concrete products, such as fence posts, block, brick, tile, sewer pipe and similar concrete work of thin section. It is particularly important that the concrete be kept moist for several days before directly exposing to summer temperature conditions. Forms should not be removed if they can just as well be left in place.

Wet concrete block and brick thoroughly when laying up in the wall during hot weather. If this is not done they will draw an excessive amount of water from the mortar, thus making mortar joints porous and weak because of loss of water.

Cast Stone Blocks Become Popular

Featuring concrete blocks that will not sweat, that have all of the durability and serve their purpose as well as cut stone, the Zagelmeyer Cast Stone Company of Detroit has experienced one expansion after another. The plant is at Twelfth street and the Detroit Terminal Railroad, Detroit, and it has been a habit to double the capacity each year. Recently this rule had to be broken to take care of orders and equipment and men have been added increasing the daily output to a total of 4,500 concrete blocks daily.

The Zagelmeyer product is held in high favor by building contractors because it is dependable and the process eliminates the undesirable qualities of some blocks.

This is one of the largest concerns in the country in its line, and makes wet process blocks, the concrete being poured into the molds instead of being tamped, the result being the most durable and satisfactory block. Extensive building operations which are continuing throughout the city of Detroit and the many projects for the near season has put the production of this cast stone up to the high water mark. The production was great last year, even to attracting outside attention, but the 1917 record promises to overshadow all others.

The Zagelmeyer Company also has a process of veneering with clear crushed granite, which adds to the appearance of the blocks used in foundations and in interior work.

Concrete blocks are growing in popularity every year through the ease of handling and qualities which make them proof against both time and elements and the Zagelmeyer Cast Stone Company has developed their manufacture to the highest degree.

Anticipating a great amount of building this year, the Zagelmeyer company laid in big stocks, hence there has been no change in the price list since February 1. Deliveries are made with promptness.

Increased Freight Rate on Gravel Is Allowed

Authority to increase from 70 to 77 cents the joint freight rate on gravel in carload lots from Massaponax, Virginia, to Norfolk was granted the Richmond, Fredericksburg and Potomac, the Norfolk and Western, the Atlantic Coast Line and the Seaboard Air Line Railroad companies yesterday by the State Corporation Commission. The railroads, which asked in their petition for an increase of 85 cents, will be allowed to increase the rate upon notice of not less than ten days to the public and the State Corporation Commission by a publication of their tariff.

The opinion of the commission deals at length with the hearing conducted some time ago in the matter, and reviews the testimony introduced both by the railroads and those opposing an increase in the rates. The gravel business in the State, and the various rates and arrangements that have been in effect for some years, are also reviewed in the opinion.

On April 20, 1916, the Richmond, Fredericksburg and Potomac Railroad Company applied to the commission for authority to increase the then-existing rate of 70 cents per ton of 2,000 pounds, on gravel in carload lots, from Massaponax to Norfolk, via either of the other railroads, to 85 cents per ton without change in the minimum carload weight, which is 80,000 pounds. The petition of this road was in behalf of all of the four lines which participated in the rate.

Following the publication of the proper notice, the Southern Sand and Gravel Company and the Musterfield Sand and Gravel Company, with plants located at Massaponax, intervened and opposed the increase in rates, and were made defendants to the petition. The commission, in its opinion, reviews the various rates and arrangements between the railroads for the handling of this traffic. Comparison between the rates of coal and gravel were made, but it was admitted that the latter was among the lowest-grade articles transported.

The opinion says that the "attorney for one of the interveners caused information to be put in the record of the rates on sand in carloads applying from Norfolk and Petersburg on the one hand, to various points in the coal fields of Virginia and West Virginia over the Norfolk and Western Railway; the rate to Pocahontas, a representative destination, being \$1 per ton of 2,000 pounds; the distance thereto from Norfolk being 375 miles and from Petersburg 293 miles. However, we think that these rates, ranging from \$1 to \$1.26 per ton of 2,000 pounds, are not fairly comparable with the rate in question on gravel, on account of the different conditions under which the different transportation services are given, one movement, the westbound, in this instance, being made against grade, but for which empty coal cars returning to the mines are used."

Decision Based on Loaded Car Mile Earnings

The commission reached its decision largely through its consideration of the earnings per loaded car mile, and writes that "while the average car mile earnings on all of the traffic handled on each road for distances equal to its haul of the gravel would probably be higher than the general average shown in the exhibit, for the reason that short-haul rates are relatively higher than longer hauls, yet it is probable that even if the average car mile earnings for traffic carried the exact distances of the gravel hauls respectively could be ascertained, they would show a result less than the car mile earnings on the gravel from Massaponax carried at the rate of 70 cents per ton.

"We think that the car mile earnings are more illuminating than the ton mile earnings. We consider the

rate of 70 cents per ton on gravel from Massaponax to Norfolk, via Petersburg and the Norfolk and Western Railway, to be somewhat lower than would be prescribed by the commission, and it is our conclusion from the facts and circumstances presented that the petitioners have not justified the rate of 85 cents per ton proposed by them, and, further, that a reasonable rate will be 77 cents per ton of 2,000 pounds, with a minimum carload weight of 80,000 pounds. This rate will yield per ton miles revenue of 4.75 mills and a revenue per car mile of 23.77 cents on a load of fifty tons."

Concrete Stock Bins

The cut shown herewith illustrates the concrete stock house recently completed by D. F. Hoag & Company, builders of Minneapolis, for the Fort Dodge Portland Cement Co., at Gilmore City, Iowa. This stock house consists of eight circular bins 20 feet in diameter, 68 feet deep, three inter-space bins, and a machinery shaft in which is placed an elevator and a manlift, whereby a man can go from the lower floor to the head floor in less than a minute and without any special effort on his part. These bins are constructed entirely of re-inforced concrete with concrete slab roof covered with 4-ply asphalt roofing.

In planning the 27 circular cement stock bins for the Duluth plant of the Universal Portland Cement Company consideration was given to preliminary plans showing both rectangular and circular bins, but with the introduction of small storage units it was evident that the cost of the rectangular structure per barrel of storage capacity would exceed that of circular bins.



The new plant of the Fort Dodge Portland Cement Co. Showing Concrete Stock Bins.

Following a series of experiments conducted on the bins at Mill No. 3 stockhouse, it was concluded that although cement maintains a more or less stable angle of repose, conditions arise to prevent a uniform flowing action while being discharged or drawn from the bottom of the bin, and the cement is likely to remain or hang in a vertical position, or possibly even "undercut." It was further concluded from these experiments that a wall designed to withstand a hydraulic pressure of 20 pounds per square foot is ample to take care of any likely variations of pressure that will occur in bins of the usual dimensions and say of 40,000 barrel capacity. These experiments, though not conclusive, furnish the only data at present available upon which to base a rational design.

In one of the previously built stock houses of this company the design was based on a hydrostatic pressure of 20 pounds per square foot and no visible sign of overstraining has developed in this structure.

Plant of the Columbia Quarry Company

The Columbia Quarry Company's plant is situated in Illinois, about fourteen miles southeast of St. Louis on the Mobile and Ohio Railroad. This plant is an excellent example of a good sized, up-to-date crushing plant. It has an output of 3,000 tons of crushed rock per day. This rock is a hard limestone of very good quality, especially well adapted for railroad ballast, county road work, concrete and fluxing.

The quarry is 1,500 feet in length with a face of about 75 feet. The rock is loaded by two steam shovels. The stripping, which consists of 6 feet of sandy clay, is handled by a 30-ton revolving shovel which loads into a 1½ yard Western side-dump cars, manufactured by Western Wheeled Scraper Co., Aurora, Ill. About 400 cubic yards a day is taken away.

ing Company of Milwaukee. It is then elevated by a No. 12 Allis-Chalmers elevator, passing over a 60 in. x 20 ft. revolving screen, where everything from 2¾ inches down is screened out. Stone over this size passes over this screen by gravity to a No. 8K Gates crusher where it is recrushed. This stone is then elevated by a No. 8 bucket elevator and is screened over two 48 in. x 12 ft. screens, making 2-inch, 1½-inch, 1-inch, ½-inch stone and dust. Any stone over 2 inches in size from these two screens is carried by a belt conveyor to the bins directly over two No. 5 crushers, where it is recrushed. This stone passes directly to the No. 8 bucket elevator, where it again is carried to the two 24 ft. x 48 in. screens. The No. 3 crusher is used to recrush 2-inch stone where more fine stone is needed. All crushers, screens, elevators and hoists are of the Allis-Chalmers Manufacturing Company's make. All machinery with the exception



The Columbia Quarry Company's Property at Columbia, Ill. They Operate Cyclone Big Blast Hole Drills, Allis-Chalmers Crushers and Western Wheeled Scraper Company's 1½ Yard Side Dump Cars.

The face of rock runs between 70 and 75 feet in height. This is drilled by two No. 14 Cyclone Big Blast Hole drills, which are operated by 10 horsepower Allis-Chalmers motors. A smaller drill of the same make has been used, but this is soon to be moved to another quarry operated by this company. The Cyclone drills are giving good service and the company is well pleased with them.

The No. 14 drills drill the full depth of the face from 8 to 10 feet apart and about 25 feet from the face. From 50,000 to 100,000 tons is shot down in a blast, 40 per cent nitro-glycerine dynamite is used. It is intended to plan the work in the near future, so that 350,000 tons is blasted at a time. Pieces of rock too large to be handled by the shovels are subsequently worked with jack-hammer drills and re-blasted.

The shovels load into 5-yard, side-dump cars, which are hauled in trains of from six to ten cars each by a 16-ton Porter locomotive to the foot of the incline, up which they are hoisted by cable.

The rock is crushed by a No. 12K Gates type gyratory crusher, built by the Allis-Chalmers Manufactur-

of the three steam shovels and locomotives are operated by Allis-Chalmers 25 cycle, 3 phase, 440 volt motors.

The plant is equipped with one 150, one 100, one 75, two 60, one 40, three 30, one 20, two 10 and two 5-horse-power motors. There also are in the plant two vibrating screens manufactured by the Jeffrey Mfg. Company used to re-screen the ½-inch rock. The crushing capacity is over 3,000 tons per day.

The finished product is fed into railroad cars where it is either shipped out or stored in storage piles. The quarry has lately been equipped with a 30-ton locomotive crane with clamshell attachment. This locomotive crane does a great deal of switching of the cars and handles the rock to and from the various storage piles. It is always the aim to carry a large supply of all sizes of stone in the storage piles, so as to be able to take care of any sudden demand.

The plant is in charge of Cris Hosted, general superintendent, Columbia, Ill. The office of the company is in the Fullerton Building, St. Louis, Mo.

The Jefferson Tile Works

Among the many progressive concrete tile plants in Iowa is the Jefferson Cement Products Company of Jefferson, Iowa.

Their factory building shows a careful regard for the details of the plant that is a standing advertisement for the careful workmanship of their cement tile. There are no disorderly piles of material outside, waiting to be used, but the appearance is that of a well conducted, modern manufactory where first-class raw materials are carefully converted into an honest product.

The completed tile shown in the foreground are for land drainage, and comprise the only product of the plant. Many tile plants have in the last few years taken up the problem of cement drain tile, with notable success, and plants like the one shown above, making a first-class product, are rapidly placing the cement drain tile industry on a solid basis and establishing for it an excellent reputation.



The advertising of drain tile begins at the plant. The tile in the yard awaiting shipment and a well designed and well-built factory speak as loudly as newspaper advertising for the product. The effect of this, however, can be readily lost by the accumulation of defective tile and the littering up of the yard with unused material. If all plants engaged in the manufacture of cement products would profit by this moderate priced 365-day advertising, they would probably find an immediate effect upon sales.

Clinchfield Cement Corporation Improvements and Additions

Less than five years ago the Clinchfield Portland Cement Corporation, Kingsport, Tenn., built one of the largest Portland cement plants in the South, and this has been so successful that it has recently had to double its capacity, giving from 2,500 to 5,000 barrels daily, and is now spending over \$300,000 for trebling its power plant and \$100,000 for a modern lime plant.

The company has just started construction on the lime hydrating plant from plans prepared by Richard K. Meade, engineer, Baltimore, Md. At present this plant is being constructed to provide a daily capacity of 100 tons of hydrated lime and 60 tons of lump lime, although the plant has been so designed that any department can be enlarged to any extent desired without interfering with the operation of the initial unit.

The kiln building will be 60x120 feet and provide for five vertical kilns designed by Mr. Meade. The hydrating building will be 42x60 feet. Other equipment in the plant will include a Raymond mill and air separator, furnished by the Raymond Bros. Impact Pul-

verizer Co., Chicago, Ill.; Bates valve bag machines for packing the lime in bags, supplied by the Urschell-Bates Valve Bag Co., Toledo, O., and a William mill for pulverizing the lime for agricultural purposes, made by the Williams Patent Crusher and Pulverizer Co., St. Louis, Mo.

The limestone for this plant will be stored in bins and delivered to the plant in an especially constructed elevator furnished by the Standard Electric Elevator Co. of Baltimore, Md.

Storage for 2000 tons of hydrated lime will be furnished by four reinforced concrete silos, each 30x32 feet and equipped with automatic conveyors. This method of storing hydrated lime is an entirely new feature, and this is the first plant to be built in the country with equipment of this character.

The entire plant will be electrically operated. All the buildings will be of steel.

They are also erecting a large addition to their power-house for the purpose of supplying power to the dye plant and other industries in the town. This plant, which is being designed and constructed by Ford, Bacon & Davis, New York city and New Orleans, will increase the capacity of the plant from 4000 kilowatts to 12,000 kilowatts and will cost between \$300,000 and \$400,000. The turbine-room will be 62x55 feet, and the boiler-room 102x48 feet. All contracts for construction and equipment have been placed, and work on excavations and foundations was recently started by the Oliver-Hill Construction Co. of Knoxville, Tenn.

The principal equipment includes the following: Two 4000-kilowatt turbines with condensers, furnished by the Allis-Chalmers Manufacturing Co., Milwaukee, Wis.; four 600-horse-power boilers and superheaters, a concrete stack, 12 feet in diameter and 235 feet high; stokers; switchboard.

\$20,000 Damages Asked

David Byers has filed suit in the circuit court against the Standard Portland Cement Company, Leeds, Ala., for \$20,000 damages for alleged personal injuries. Plaintiff's petition sets forth that he was employed at the company's plant on June 6, and was struck in the eye by a burr from a machine at which he was working.

Tariff Laws Complained Against

A complaint was filed with the Public Service Commission, Harrisburg, Pa., by the Lehigh Portland Cement Company, Allentown, Pa., against the Buffalo, Rochester and Pittsburgh Railroad Company, stating that new tariff laws are to become effective August 16 increasing the internal charge for all freight except coal and coke. In the case of the cement company the charges will be changed from \$2 a car to 20 cents a ton, which the complainant alleges to be "excessive and unreasonable."

The Kosmosdale Portland Cement Company's plant, at Kosmosdale, Ky., was in full operation yesterday for the first time since a strike of workmen was inaugurated a week ago. Appeals to the patriotism of the men resulted in scores of them returning to work, according to officials of the plant. Much of the cement being turned out is being used in the building of walks and other essentials to the local cantonment and other military establishments. The plant had been running day and night for the past several weeks.

The strikers assert they have been compelled to work twelve hours a day on both the day and the night shifts. They have demanded an eight-hour shift at the wages paid for the twelve-hour shift.

Despite the return to work of most of the strikers, private detectives and county police are on guard at the plant as a precautionary measure against trouble.—[Louisville Journal.]

The Use of Artificial or Imitation Stone

By Paul Denivelle

The San Francisco City Hall is not the first municipal building to use artificial or imitation stone in its interior. The recently completed Municipal Building in New York contains artificial granite and Botticino walls and groins throughout practically its entire ground floor, which were installed by the writer.

As in the San Francisco City Hall, the simulation of stone was devised simply because of economy, without sacrifice to effect. In the latter, the upper portions, including the four large niches at angles (including the large sculptured groups) up to spring line of the dome, were made in this material. There was no attempt to do more than match the stone used in the lower portion of rotunda. Each unit was cast to the jointing in proper stone stereotomy. With the existing multitude of breaks and odd variety of architectural forms, the saving cost over stone was naturally considerable. Besides, it had the additional advantage, from the architect's viewpoint, of true and perfect reproduction in the ornamental enrichment, which, of course, were perfect replicas of the sculptors' models, devoid of the danger of inferior interpretation through the varying ability of different stone carvers.

Is the coming era of architecture to be the age of artificial stone? The writer believes it to be. I would advance three reasons: First, the latest all-pervading aim for texture and color as a requirement to architectural expression. This being admitted, the second reason is that this quality in the natural stones is limited both as to texture and color, whereas in the artificial it would not be. The third and most important reason is that the recent development in the manufacture of true White Portland Cement and a growing progressive knowledge in its uses open a wide field of possibility, almost unlimited, in stone texture and color not necessarily dependent on simulating existing natural stone, but rather designedly apart therefrom. I advance this latter reason independently of the economy in cost, that ever-present barrier to the architect's ever-growing ambition to a higher type of expression in all forms of architecture, an ambition which this age of commercialism generally curbs or often stifles entirely. The limitations of terra cotta are such, due to warp in burning, as to preclude its substituting stone because of necessity of small units and wide, irregular joints. Color tones must be obtained by glazing surface, depriving it of stone texture.

Must we stop in seeking effects of stone texture and color to that furnished us by nature today? Decidedly not, if one's sense of due proportion be sufficient to balance the result as to keep from approaching the grotesque in effect. Bearing out this contention, I know a case in point where the "imitation" was decidedly superior to the natural used therewith that an effort to improve the latter was at once made for a more harmonious result.

To really accomplish this end, however, it is quite obvious that the present mediocre use of White Portland Cement materials in architectural expression must be elevated far above the present level prevailing today. Viewing present results in our plastered cement buildings, one must be an optimist of considerable courage to believe that our present use of natural stone will be superseded eventually by the simulated or a purposely unnatural but superior artificial product. The extensive use of all cements as used today and the generally banal cheap attempts at surface texture and color as extemporized, are too apt to

be used as a standard of measurement by the architect with reasonable prejudice and is, to my mind, the main obstacle to be surmounted in order that a proper cost allowance may be kept in mind, considerably above the stucco, etc., of today, yet more economical than any stone available with any but ordinary expression. It was while probing into the possibilities of this field some ten years ago that it fell to my lot to introduce the first White Portland Cement of brand now extinct. The interior of the Pennsylvania Station, New York, was the first practical result of artistic merit produced by the use of White Portland Cement on an extensive scale. This was in the form of simulated Roman Tervertine. This material also covers the interior walls of the recently completed Union Station at Ottawa, Canada.

All obstacles can be and are overcome when the cost of the consideration of the artificial work proposed is still commensurate in lesser proportion to the result attained.

Methods of Handling and Measuring Bulk Cement

There is no argument needed to convince the contractor and engineer that the elimination of the package problem in connection with Portland cement would result in economy and saving. The question which is uppermost in the minds of superintendents on the job is how to handle and measure bulk cement from the time it arrives in railroad cars until it finds its way into the charging hopper of the mixer.

There are several methods which have been successfully used, the choice of which depends upon the size of the job, railroad facilities and the general layout of the construction plant.

Bulk Cement Is Not Dusty to Handle

To those who have not used cement in bulk it may seem reasonable to suppose that it will be exceedingly dusty to handle. Experience has proved the contrary. Bulk cement in transit becomes packed so that on its arrival at destination, a man can walk on the surface without sinking in to any appreciable depth. This packing makes it possible to shovel the cement with practically no amount of dust being raised. There are no sacks to be shaken and that is perhaps the most dusty operation in the handling of cement for construction work.

Bulk Cement Used Direct From Car to Mixer

On work where cement is being used in quantities of half a car per day or more, and where the mixing plant is located within reasonable distance of the receiving siding, the simplest method of handling bulk cement is to shovel it directly from the car into wheelbarrows of known capacity and then through the provision of proper runways, wheel the cement directly to the charging hopper of the mixer. Measurement, when this method of unloading and handling is used, can be effected in the same way that the measurement of coarse and fine aggregate is done. This method is applicable more properly to work of not very great size and where construction operations will cover only a comparatively short length of time.

Where railroad facilities and the size of the work warrant it, it is advisable to provide storage for cement. This may be made more advisable on account of car shortage or the liability of irregular shipment. The most commonly followed method where storage is provided is to unload the car of bulk cement by means of a power shovel. Shovels of the type used in handling grain can be used, but it has been found more practical and efficient to use a shovel of a scoop type, having

sides and back so that the load first taken is retained. The flat shovel allows the cement to flow off either side and over the top and for this reason is less desirable. The shovel should be attached by cable to a motor or engine of from 7 to 10 horsepower. With this equipment 200 barrels can be unloaded from a car in three hours. The power shovel dumps the cement from the car into the boot of a bucket elevator which in turn raises it, discharging into the storage bin. This method should be followed where the floor of the storage bin is approximately on the level of or above the railroad track. If the track level is well above that of the storage, cement can be spouted from the car by gravity to storage.

On some work where the mixing plant has been located at a greater or less distance from the receiving tracks and the main cement storage bins have been erected over the mixers for stone, sand and cement. Those bins are so constructed as to hold sufficient material to insure the continuous operation of the mixing plant. Where this condition holds a belt conveyor from the main cement storage can be laid to the bins feeding the charging hoppers of the mixer. This belt conveyor can be fed by means of a screw conveyor running the length of the main cement storage.

Successful use has been made of automatic scales placed beneath the three material bins over the mixer for the accurate proportioning of mixes. The scales can be so set as to permit of any particular mix of concrete being delivered to the charging hopper.

The method above outlined, that is, the use of a power shovel and bucket elevator, is particularly applicable to the average plant manufacturing concrete products. It is evident that the construction of permanent storage facilities in such cases would be economical and efficient.

Use of Industrial Railways

Industrial railways have been used to a considerable extent in unloading and handling bulk cement. Industrial track is laid parallel to the receiving siding and industrial cars are loaded direct from the sand, stone and bulk cement cars on the siding. In this case measuring boxes are affixed to each car of material, so arranged that one holding the proper amount of material for one batch of concrete can be dumped directly into the industrial car, which as it travels along receives all three materials in proper proportions for one batch of concrete. Industrial track leads to the mixing plant where the cars are dumped into the mixing hopper.

Use of Dump Wagons

Bulk cement has been successfully used on work where the mixing plant was at a considerable distance from the receiving track. Tight bottomed dump wagons have been loaded directly from the car and driven to the work and the cement dumped into boxes from which it is drawn as needed. In such cases measurement is effected by the same means as employed for the coarse and fine aggregates. The point might be raised that there would be no protection from damage by water if such a scheme were followed and accordingly attention is called to the fact that cement sacks do not keep cement from getting wet, but rather tend to absorb moisture, thereby actually increasing the liability of damage to cement by water.

As has been previously mentioned, before determining the method to be employed in handling bulk cement, local conditions and facilities should be thoroughly investigated and the nature of the work given due consideration so that that scheme which is most properly adapted to the job can be used.

Stroh Steel Hardening Described

"The Stroh process is a method for casting the finest alloy steel together with ordinary soft steel in one solid piece. The resultant casting has a wear-proof alloy steel stratum upon the wearing surfaces, while the body is composed of any desired steel and is in no way affected. This alloy can neither come loose, nor spall, nor spread or flow. Its depth or thickness, its location and its hardness are completely controlled and are varied according to the size of the piece and nature of service expected." With this introductory statement the Stroh Steel Hardening Process Co., Pittsburgh, Pa., in its most recent publication relating to its business, proceeds to describe and illustrate in the most entertaining and instructive manner its methods of manufacturing carbon steel, titanium, vanadium, nickel or manganese steel castings of not less than 50 pounds weight, with or without the Stroh process. Among the articles made are "wear proof" gears of various sizes and kinds, steel spindles, pinions, slugger rolls, cement mill castings, mine car wheels, etc., besides a variety of other machinery parts requiring great wearing qualities. "The actual percentage of the weight of a steel casting which is worn away in practice is generally very small," says this book. "For illustration: The teeth of the average gear constitute less than 10 per cent of the total weight. A worn tooth weighs one-half as much as a new. The remainder, or 95 per cent, has been used merely for supporting weight or stress and is never worn out. It is quite obvious that a hard material is of no benefit in this greater portion and is nearly always detrimental. * * * But to get such an alloy (the Stroh alloy) in and on the parts subject to actual abraision, and still to keep the easily machined and cheaper material in the other 95 per cent, means to combine the advantage of both at about three cents per pound additional instead of 90 cents. This is exactly what the Stroh process does." The book will amply repay perusal in detail.

Castings and Lubrication for Link-Belt Silent Chain Drives

It comes to our attention now and then that some silent chains are operated without the use of lubricant. We are sometimes confronted with the question therefore, "Can link-belt silent chain drives run without oil? And why do you recommend the use of casings for your drives?"

It is a principle of practical mechanics that any chain drive will run better, last longer and require less attention if it operates through an oil bath in a tight casing, than if it runs exposed, with little or no oil.

Silent chains—all makes—being composed of many links and joints, and run at high speeds, require oil—just like other machinery. To contend that this is untrue violates a "first principle" in the operation of machinery.

A watch needs oil. An engine runs smoothly if well lubricated. Any moving parts will work easily, without undue friction or noise, if properly designed and well lubricated. The fact is so elemental and so well established, particularly with those in mechanical occupations, that it precludes argument on the subject.

Safety-first is a watchword in the modern plant today. Casings make for absolute safety—they completely cover all moving parts, and are often worth their small additional cost for this feature alone. Employees feel a sense of security around covered machinery.

Link-belt silent chain is the ideal medium for power transmission. It is flexible as a belt—positive as a gear—more efficient than either. Send for descriptive catalogue.

Cement Shipped to Chile

Consigned to Antofagasta, Chile, thirty cars of cement have left the plant of the California-Portland Cement Company, Colton, Calif., inside of a week for San Pedro to be loaded aboard a boat bound for South American ports. The cement was not shipped in the customary sack form, but in wooden barrels, and the company has the satisfaction of being told by the South American firms with which it deals that it is the best packed of any coming into their hands. Many orders for cement to be used in construction work in Chile and elsewhere are at hand, but on account of the war, boats are scarce, which holds up the shipments.

According to Supt. E. J. Strock, the cement plant has never run heavier in its history than at the present time, all the kilns but one being in use. The plant has been fortunate in losing so far, only one man by the draft, others called being exempted on account of wives and other dependents.

The City Council of San Diego, Calif., opened bids on 85,000 barrels of cement. The bid of \$1.63 a barrel f. o. b. Colton, Calif., submitted by the California Portland Cement Company was accepted.

Concrete Road Tamping Machine

A tamping machine which, according to reports, has been used successfully in concrete road construction in California, has recently been placed on the market by the Cowell Portland Cement Company of San Francisco, California.

The machine runs longitudinally along the road on flanged wheels rolling on side forms. It follows closely after the mixer, leveling off the concrete, tamping it and finishing it in one operation. The machine is driven by a 1½-hp. gasoline engine and is provided with a traction device for moving it along the road under its own power. The machine is provided with two templates, the forward one working horizontally to level off the concrete and the other one working up and down to accomplish the tamping. The machine is built in various sizes for roads of different width and is stated to be able to level, tamp and finish 200 lin. ft. of pavement per hour.

U. S. Public Roads' Great Need

The public roads throughout the country, contends J. E. Pennypacker, which constitute the primary means of transportation for all agricultural products, for many millions of tons of forest, mine and manufactured products, and which for a large percentage of farmers are the only avenues of transportation leading from the point of production to the point of consumption or rail shipment, have been improved to only a slight extent.

By reason of this fact, the prevailing cost of hauling over these roads is about 23 cents per ton per mile. More than 350,000,000 tons are hauled over these roads each year, and the average haul is about eight miles, from which it can readily be seen that our annual bill for hauling over the public roads is nearly \$650,000,000. The cost per ton-mile for hauling on hard-surfaced roads should not exceed 13 cents. It is therefore evident that if our roads were adequately improved a large annual saving in the cost of hauling would result.

The difference between 23 cents and 13 cents is 10 cents, which is the ton-mile tax of poor roads which the city people pay, for most of the hauling is toward markets for shipping points and the cost of this hauling is part of the total expense of products of the

land to the consumer. The total is about \$280,000,000, which the 45,000,000 people living in the cities and towns of the United States pay annually on account of poor roads. This averages over \$6.00 a year per person.

How to Hold the Venezuelan Market for Construction Materials

Practically all of Venezuela's imports of construction materials and supplies are now coming from this country, but we are in danger of losing much of the trade as soon as the war is over. Just where the danger lies and what the trouble is is carefully explained by Special Agent W. W. Ewing in our latest publication, "Markets for Construction Materials and Machinery in Venezuela," Special Agents Series No. 144, writes C. D. Snow, assistant Chief of Bureau of Foreign and Domestic Commerce, Washington, D. C.

This report contains a general introduction; a description of specific building activities; chapters on the markets for general construction materials, flooring and roofing materials, materials for interior finish, miscellaneous materials, and construction machinery, instruments, and tools; and a discussion of commercial practices and requirements.

Copies may be obtained at the nominal price of 10 cents each by applying to the office of the Bureau of Foreign and Domestic Commerce, Washington, D. C.

Cement Trade of the Far East

Consul General George E. Anderson, Hongkong, British China, reports that the course of the cement trade of the Far East is being materially altered as a result of freight conditions, and especially by reason of the advantage Japanese manufacturers have in comparatively low freight rates on Japanese products shipped by subsidized Japanese vessels. The annual report of one of Hongkong's largest cement companies shows a strong demand for cement but comparatively restricted trade, although the business of the company the past year has been such as to permit the payment of an increased dividend. The company has had so much difficulty in securing raw materials, however, and freight rates otherwise have so operated against it that it has not been able to take advantage of the favorable state of the market. The report of the first year's operation of the new cement concern established in the Philippines also has not been very encouraging, although the business of the concern so improved during the last half of the year that there is considerable promise for the current year; and in any event, the matter of freight rates and tonnage available affected the concern but slightly.

In Japan, however, continued growth of the business is reported, and newspaper items indicate that there was demand for more cement than could be manufactured, exports increasing from 831,952 barrels in 1915 to 890,007 barrels in 1916. The chief field for the Japanese output at present, aside from Japan and Korea and parts of China immediately adjacent, are British India, the Dutch East Indies, the Straits Settlements, and the Philippines—all reached by subsidized Japanese shipping passing through Hongkong. These vessels carry Japanese cement to India and India cotton to Japan and comparatively low freight rates in each direction are working most effectively in building up the cement and cotton industries. Much of the trade now held by the Japanese cement factories was formerly German, and the Japanese factories expect to retain this trade after the war.

Concrete in the Street Lighting Field

By Arthur J. Sweet, Consulting Engineer, Milwaukee

For some years past there has been a growing tendency to employ concrete posts or standards in connection with street lighting service. Such posts generally have been relatively low in height, seldom more than 15 feet in over-all height above ground. One of the most notable as well as one of the most extensive of these installations has been that on Lake Drive, running north out of Chicago, where a very handsome post, designed by Myron H. West of Chicago, city planning expert, has been employed. The largest of such concrete post installations for street lighting service has been that in Toronto, Canada, chiefly installed in 1911, an installation which includes practically the entire street lighting service of the city. The Toronto posts are tapered posts of square cross section with chamfered edges. These posts present a



neat appearance, but belong to the class of purely utilitarian rather than ornamental street standards.

The city of Milwaukee is now installing an entirely new street lighting system, at a total cost of approximately \$1,500,000, in which concrete posts are exclusively used. This will undoubtedly constitute the most notable installation yet made of concrete posts for street lighting service, and will also be, except for Washington, D. C., the first instances where a large city has attempted to install its entire street lighting service on an ornamental basis. Concrete posts were adopted only after a very extensive study of the problem, in which the possible use of metal posts of all types and of formed wood posts was fully considered.

It was the unanimous opinion of the architectural advisers who served the city in this matter that concrete was, from an aesthetic standpoint, the most satisfactory material available for this service. It is a notable fact that concrete posts, which were, as stated, considered to be the most desirable type from an aesthetic standpoint, were, at the same time, less expensive than any other type of lamp support except rough wood poles. Indeed, it is the personal belief of the writer, who had the chief engineering responsibility in planning the installation adopted, that the cost of employing posts of ornamental design throughout the city would have been prohibitive had it not been for the relatively low cost at which concrete posts can be obtained. The installation now in progress will employ over 11,000 concrete posts, all of ornamental design, while the ultimate installation, to be completed during a ten year period, includes over 20,000 posts. The order for approximately half of the present installation has been placed with the Universal Concrete Products Company.

The accompanying illustrations represent the primary designs of two of the four types of posts employed in the Milwaukee installation; the design finally adopted being similar in all respects except that the shafts are octagonal instead of round. These posts were designed by Miss Florence Grant, under the immediate direction of a committee representing the Wisconsin Chapter of the American Institute of Architects.

Advances in our knowledge of the principles upon which effective street lighting depends are creating a marked tendency toward mounting street lamps at greater heights above the street than has heretofore been the general practice. The posts are strong enough to support the trolley, when desired.

The only bar to a rapid extension in the use of concrete posts in street lighting service is that connected with the commercial marketing of this product. Such posts must be made in the city where they are to be used, the shipping costs being prohibitive. On the other hand, such posts are apt not to give satisfactory service unless made under the direction of one thoroughly experienced in this specialized line of manufacture. The problem of those who are interested in extending the use of cement products is to provide, for prospective purchasers, the expert knowledge and the molds and other equipment, so that the posts can be made near the point of installation. The almost ideal qualities of concrete as a material for street lighting posts will undoubtedly attract to this field the commercial organization necessary to its adequate development.

Concrete Building Block Machines

The Ideal Concrete Machinery Company, 1353 Monmouth avenue, Cincinnati, Ohio, have sent us a copy of their new catalog No. 28, containing 100 pages, well illustrated.

Fifteen reasons are assigned in this handsomely printed book why Ideal concrete block machines are supreme and then is given a complete description of the various equipment manufactured by the company. The book covers every detail of the blockmaking industry and should be in the hands of every one who is interested in this branch of the industry. In addition there are shown numerous half-tone illustrations of attractive residences and other buildings built largely with Ideal equipment. Ask for a copy; it is well worth it.

Ohio State Concrete Roads Have New Specifications

Proportioning Permits Use of Variable Amount of Cement—Mix to Be in Machine at Least

One Minute

New specifications for roads issued by the Highway Department in the State of Ohio under the direction of Clinton Cowen, State Highway Commissioner, have some interesting provisions regarding the specifications for concrete pavement.

In proportioning, for instance, the specification reads as follows: "The ingredients of concrete shall be mixed in the proportion of one sack of cement to $1\frac{1}{2}$ cubic feet of fine aggregate and not more than 3 cubic feet of coarse aggregate. The mortar shall always be more than enough to fill the voids in the coarse aggregate. If necessary to secure this result, the proportion of coarse aggregate shall be reduced. In general this will require from seven to eight sacks of cement per cubic yard of concrete, depending upon the class of aggregate used and the percentage of its voids." There is no method given, however, of determining when the voids are filled.

Consistency Requirements

In consistency, the new specification is as follows: "The materials for the pavement shall be mixed with only sufficient water to produce a concrete which will settle very slowly when deposited in a pile and which will hold its shape when struck with a templet. The consistency shall not be such as to cause a separation of the mortar from the coarse aggregate when handling. After the concrete has been lightly tamped, there shall be no free water in evidence. Individual particles of the coarse aggregate when so isolated shall show a coating of mortar containing its proportionate amount of sand." In this specification also there is no quantitative measure for any of the results demanded.

For machine mixing, it is required that the mixing shall continue at least one minute until the drum has made not less than twelve revolutions at a speed of between 12 and 18 r.p.m. before any part of the batch is discharged.

Definite Information Given as to Finishing the Concrete

For the finishing of the concrete, very definite information has been given. As the finished surface must conform within $\frac{1}{4}$ inch to the templet or straight-edge laid parallel to the center line, the procedure is given. By a combined horizontal and crosswise motion the concrete is struck off $\frac{1}{2}$ -inch high, then tamped and finally recut to the exact finished pavement. When 3 feet from the joint the templets are lifted to it and then leveled and compacted away from the joint. An 8-foot wooden float, not less than 6 inches wide, is to be operated from two bridges, and this float is given in a detail drawing in the specification. The axis of the float is to be parallel to the center line of the pavement. For final finishing a float 20 inches long and 6 inches wide is used, or a belt may be employed. At the joints a split float is specified. All of these floats are to be provided by the contractor at his own expense.

The Hawkeye Cement Tile Company plant at Mason City, Iowa, has been purchased by the Cement Products Company of Spencer, and is being remodeled and enlarged.

Sawyer Conveyor Belts

It seems quite natural when one speaks of Conveyor Belts to connect them with grain or cereals, but there are many places in which SAWYER Belting is used for conveying purposes besides these, where it is giving unusual service.

In a recent issue of THE BOOSTER we showed an illustration taken from a photograph of the new high-level bridge being built by the City of Cleveland. This bridge will stand for years as a monument to the credit of the city, and we trust we may be pardoned for drawing a parallel that it will also stand as a monument for SAWYER Belting, as it conveyed every pound of concrete material in its construction.

Speaking of concrete reminds us that we have equipped many Cement Plants with regular Genuine SAWYER Belting, and are almost daily furnishing Belting to some plant of this sort.—[Sawyer Belting Monthly Booster.]

Concrete Shingles

Bristol, Conn., is soon to have a concrete shingle industry for which a plant is already in process of erection. The machinery and molds for manufacturing these shingles are being furnished by the Walter Concrete Machinery Company, 418 Saks Building, Indianapolis, Ind. The concrete shingle has been for 25 years in successful use in Europe, but it was not brought to this country until 1908, when its manufacture began in Indiana and Illinois. The concrete shingle can be made and sold to compete with wooden shingles in price, and in time is likely to succeed wooden shingles, which are getting scarcer and higher all the time. Bristol is a sandy country and one well suited to lines of concrete work.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912,

Of Cement & Engineering News, published monthly at 672 Transportation Bldg., Chicago, Ill., for April, 1917.

STATE OF ILLINOIS, }
COUNTY OF COOK. } ss.

Before me, a Notary in and for the State and county aforesaid, personally appeared Jno. F. Waldron, who, having been duly sworn according to law, deposes and says that he is the Business Manager of the Cement & Engineering News, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse side of this form, to-wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher, Wm. Seafert, 672 Transportation Bldg., Chicago.

Editor, Wm. Seafert, 672 Transportation Bldg., Chicago.

Managing Editor, Dr. W. Michaelis, 672 Transportation Bldg., Chicago.

Business Manager, Jno. F. Waldron, 672 Transportation Bldg., Chicago.

2. That the owners are: (Give names and addresses of individual owners, or, if a corporation, give its name and the names and addresses of stockholders owning or holding 1 per cent or more of the total amount of stock.)

Wm. Seafert, Sole Owner, 672 Transportation Bldg., Chicago.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.)

None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

JOHN F. WALDRON,
Business Manager.

Sworn to and subscribed before me this 19th day of September, 1917.
[SEAL.] FRANK W. MIKVICKA.

(My commission expires October 30, 1917.)

The Car Shortage Situation

By W. E. Law, Sales Mgr., Clinchfield Cement Co.

The far-reaching influence which the loading of freight cars above the rated capacity will have in relieving the car-shortage situation of the country is strikingly brought out in the following letter received from W. E. Law, sales manager of the Clinchfield Portland Cement Corporation, Kingsport, Tenn.:

"As soon as the car situation began to get so serious throughout the country we, in our efforts to co-operate with the railway, advised our representatives and our customers that the capacity of the car would be our minimum car until otherwise advised. While we have the privilege of shipping 40,000 pounds for a carload, we have been shipping as near 10 per cent above the stenciled capacity of the car as is possible for cement companies to do. During the month of July we shipped 358 cars, averaging 251 barrels to the car, or 47.8 tons per car. We load 173 barrels, or 65,740 pounds, to each 60,000-capacity car; 231 barrels, or 87,780 pounds, to each 80,000-capacity car, and 289 barrels, or 109,820 pounds, to each 100,000-capacity car, and during the month of July we were able to load all of our cars in this manner, and having been able to secure quite a number of 100,000-capacity cars, we averaged 95,380 pounds to the car.

"I believe that if all manufacturers and all shippers would make an effort to keep cars moving, and not delay them in loading or unloading, and at the same time use the full capacity of the car, it would in a great way relieve the serious situation throughout the country.

"Right here I want to call your attention to the co-operation on the part of our customers, who, realizing the situation, consented for us to ship capacity cars to them when they really did not need more than a minimum car."

A study of these figures shows that by a 10 per cent overloading an equivalent of an additional 36 cars was obtained during the month. If this average was maintained for twelve months, it would mean more than 400 cars additional for the year for the Clinchfield Portland Cement Company alone. If all the cement plants of the country, which are now producing about 100,000,000 barrels per year, were maintaining the same average of overloading as the Clinchfield Company, this would mean in the cement industry alone that the overloading would be equivalent to nearly 40,000 additional cars a year. Carrying this estimated saving to all the industries of the country that are able to co-operate in this important movement, it is readily seen that a 10 per cent overloading, while apparently small in some individual cases, will amount in the aggregate to an equivalent of an enormous number of additional cars per year.

Another interesting point brought out in this letter is the readiness with which consumers have co-operated with the Clinchfield Company by agreeing to receive capacity cars when they do not need more than a minimum car. It is this co-operative spirit between the manufacturer and the consumer which is reflecting in so striking a manner the patriotic willingness of American manu-

facturers to work closely with the Government in helping it to conserve our resources and provide for the most efficient operation possible in every branch of activity.

Special Cement Rates

An order was issued recently by the railroad commission of Texas, approving the application of the International & Great Northern Railway Company making cement in carloads minimum carload weight 60,000, between Cementville and points named subject to the following charges:

To San Antonio (points on International & Great Northern tracks within city limits), 1½ cents per 100 pounds; to San Antonio (points on International & Great Northern tracks at Camp Kelly or South San Antonio), 1½ cents per 100 pounds plus \$5 per car.

It is stipulated that these rates are not to be used as basing rates or as a division or basis for division on shipments to stations beyond.



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Cement and Engineering News

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IT takes time to establish a standard in any line of construction. In pavement construction concrete became the well recognized standard for sidewalks some years ago. Today it has become the standard of alleys and indications point to its taking the lead in the near future for country roads for certain classes, at least, of city streets.

The illustration below shows the concrete road between Monroeville and Norwalk, in Huron County, Ohio. This was built in 1914 by the Modern Construction Company, Fremont, Ohio, under the supervision of the county highway engineer.



Concrete Road between Monroeville and Norwalk, Ohio

CEMENT AND ENGINEERING NEWS

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Advertising copy or changes in ads. must be in this office by the 25th of each month, as hereafter our magazine will appear on the 5th of the following month

Advertising Rates Sent on Application

JOHN F. WALDRON - - - - - Advertising Manager

CHICAGO, NOVEMBER, 1917

Outlook for Cement Trade

During the last year or two we have seen a rapid improvement in the cement industry. While production has continued to increase, there has also been a great increase in demand. A wider range of uses for the material is very largely responsible for this increase in demand. Perhaps the greatest factor for better conditions in the industry, however, has been the prosperity of general business in this country during the last two years. Other materials have advanced rapidly in price, which fact has further reacted on cement and boosted the price in accordance with the general market for building materials. Furthermore, new uses for cement are being found almost every week. One of the most striking is the employment of cement in building trenches in France. According to reliable reports, these concrete trenches are the most enduring and generally satisfactory trenches on the whole line of battle.

It would be needless to point out the various classes of work which now depend upon concrete, whereas several years ago concrete was not even considered for those particular operations. Perhaps no better proof of the tremendous vogue of cement and concrete construction is to be found than the fact that this country is now producing a greater amount than any other country in the world, and that during the last fifteen years our annual output has increased from 17,000,000 to nearly 95,000,000 barrels.

Iowa's Cement Output

This is a cement age and Iowa is playing an important part in the production of this building material. Figures announced by Prof. G. F. Kay, director of the Iowa State University's department of geology, shows that the production in the last year is the greatest up to this time, the value of the output being \$5,063,647. In 1913 the output was worth \$3,972,876, in 1914 the value was \$4,008,915 and in 1915 the value of the production was \$4,119,952.

The development of the Portland cement industry in Iowa has been rapid. Since 1911 there have been three modern cement plants in Iowa—two at Mason City and a third at Des Moines. A fourth has just been constructed at Gilmore City.

Cement Association's Fall Meeting

The Blackstone Hotel, Chicago, was the scene of an intensely interesting four days' convention of the Portland Cement Association, Monday to Thursday inclusive, September 10-13. The radical readjustments in the cement world caused by war developments, the big problems of labor shortage, car congestion, the threatened fuel famine and their corollaries, absorbed nearly every moment of the four days' session.

The shock to the delegates caused by the sudden death of J. P. Beck, general manager of the Association, on the previous Saturday morning, cast a shadow over the conference, as there was scarcely any one in attendance who was not personally acquainted with his forceful personality and indefatigable executive ability.

At a meeting of the Board of Directors subsequent to the conference, H. E. Hilts, of San Francisco, was chosen to succeed Mr. Beck as general manager. Mr. Hilts, at the time of his election was district engineer for the Association, with headquarters in San Francisco.

New York was announced as the choice of the Association for the annual meeting, which will be held at the Hotel Biltmore, Monday to Thursday inclusive, December 10-13.

The conference subjects at the Blackstone meeting, with the ones who were scheduled to introduce each one in turn are as follows:

"Labor Turnover and the Employment Problem in Cement Plants," Joseph Brobston, vice-president of the Dexter Portland Cement Co.

"The Recovery of By-Product Potash in Cement Plants," John J. Porter, first vice-president of the Security Cement and Lime Co., Baltimore.

"The Economical Use of Coal in Kilns," J. H. Lendi, electrical engineer of the Universal Portland Cement Co.

Perhaps the most important discussions were those devoted to the reports of association committees. These committees and the names of the chairmen presenting their reports are respectively:

The Committee on Trade Practices, R. H. Hughes, chairman.

The Committee on Concrete Ships and Barges, E. D. Boyer, chairman.

Committee on Accident Prevention and Insurance, William H. Baker, chairman.

Committee on Uniform Cost Accounting, Charles F. Conn, chairman.

Committee on Transportation, M. N. Billings, chairman.

The Committee on Technical Problems, F. W. Kelly, chairman.

Committee on Packages, W. D. Lober, chairman

Committee on Conservation, J. W. Kittrell, chairman.

Committee on Credits and Collections, W. E. Viets, chairman.

The conference banquet on Wednesday evening, September 12, was made memorable with addresses by Franklin H. Wentworth, secretary National Fire Protection Association on "The Fight Against Fire," and James Schernerhorn, publisher of the Detroit Times, on "The Meaning of Co-operation."

A Joint Committee of the American Concrete Institute and the Portland Cement Association, to deal with the question of concrete ships and barges has just been announced. Robert W. Boyd, it is stated, has been secured as consulting engineer for the committee's work, while the committee's personnel is as follows:

Portland Cement Association—E. D. Boyer, chairman; Joseph Brobston, F. W. Kelly, W. S. Mallory, S. P. Crabo.

American Concrete Institute—H. C. Turner, chairman; Leonard C. Wason, Robert W. Lesley, Charles R. Gow, M. M. Upson.



Little River Bridge, Dade County, Florida (Luten Design). Three Spans of $17\frac{1}{2}$ to 30 Feet. Roadway, 16 Feet.
For the County Court of Dade County, Miami, Florida, 1917.

Permanent vs Temporary Bridges

By Daniel B. Luten, Indianapolis

To be permanent, a bridge must not only be made of permanent materials, but it must also be properly designed. The arch bridge of reinforced concrete has every advantage over steel and other temporary bridges, in cost as well as in all of the essentials of a permanent bridge, when properly designed.

The reinforced concrete arch is of permanent materials throughout. It grows stronger as it grows older, thus providing for increasing weight of traffic. It is readily widened without waste, thus providing for increasing volume of traffic. It is readily improved in appearance when it is widened, thus providing for growing appreciation of beauty of design by the community.

The reinforced concrete arch, when properly designed and erected, is beautiful in any location; but no other type of bridge is so readily adapted to its surroundings by a skilled designer. It employs concrete most efficiently, since it is mainly in compression; it requires neither painting nor repairs; periodical inspection as required by temporary bridges is superfluous; it has no wooden floor to be continually requiring repairs; it carries the roadway itself as well as its traffic and hence may have the same kind of road surface over the bridge as on its approaches; it is not easily moved by ice or flood; the most of its materials and labor can be purchased in the immediate vicinity so that the money expended for such bridges in public improvements is returned directly to the taxpayers.

The reinforced concrete arch is readily adapted to soft foundations. It is a heavier structure than a steel bridge, but this only necessitates that its foundations should be expanded to provide for that increased weight. If this can be done and the cost still remain below that of the competing steel bridge, obviously the soft foundations are not an objection. And once the concrete bridge is properly designed with expanded footings on the soft foundations, it has a great advantage over the lighter bridge, for the effect of moving loads becomes correspondingly negligible. For ex-

ample a steel span of 100 feet may often weigh no more than the locomotive it will carry; the concrete arch will weigh ten times as much. The locomotive loading will consequently add 100 per cent to the weight on the abutments of the steel bridge, while the same locomotive would add but 10 per cent to the weight on the abutments of the concrete bridge.

The reinforced concrete arch will sustain unequal settlements with less damage to the arch itself than almost any other type of bridge. The resulting cracks in spandrel walls may be unsightly, but failure of the arch itself has rarely resulted. Failures of deck and through girders from unequal settlements have been considerable. The reinforced concrete arch will stand almost as much punishment from unequal settlements as the steel bridge, which of course may readily rack to meet such unequal settlements without great increase in stress.

The reinforced concrete arch is the most nearly flood-proof of any type of bridge. Its abutment has its maximum pressure near the back of a wide base not readily attacked by flood scour. For equal waterway it has the longest span at lowest level, thus relieving floods at early stages instead of damming them back. It is most efficient in discharge because its center of pressure is lowest, and when flowing full, its hydraulic radius greatest. It provides the highest opening for a given span, thus permitting passage of ice and debris at highest flood stages. In addition to this its great weight enables it to resist water and ice pressure.

The concrete arch properly designed adapts itself automatically to all temperature changes without deterioration and requires no sliding plates or roller bearings which so often prove inoperative in girder bridges of concrete or of steel. The reinforced concrete arch fulfills all the requirements of a permanent bridge, which are as follows:

To be permanent a bridge must,

- (1) Consist of permanent materials throughout;
- (2) Provide for increased weight of traffic;
- (3) Provide for increased volume of traffic;
- (4) Be susceptible of improvement in design with growth in appreciation by the community.

The through girder of concrete does not satisfy the third requirement since it is not applicable with economy to a roadway more than 16 or 18 feet wide, and to admit that such a width of roadway will be sufficient in any growing community for 25 years, is to imply that the community will become retrogressive for this country and age of automobile traffic. Eastern states are now requiring 24 to 32-foot roadways on all state aid bridges. The fact that in the through girder the supporting girders are above the roadway, thus preventing widening without complete destruction, is the element of design coupled with the narrow roadway required, that renders such bridges purely temporary in character. A steel bridge would be more economical and equally permanent.

The reinforced concrete arch, however, not only meets all the requirements of a permanent bridge, but is actually cheaper in first cost than the steel bridge, which ordinarily does not meet any one of the four requirements. And this is true not only at present prices for steel, but at all times, provided always that both bridges are designed by expert designers for the same loadings. This can only be demonstrated in practice by actual competitions at letterings, and unfortunately the concrete arch is not often given a fair show in such competitions. It is a type of bridge that is easy to erect but extremely difficult to design. Hence expert engineering assistance in design is imperative if the cost is to be kept at a minimum.

The average county and city engineer, and even the state engineer, often hesitates to call in expert designers for fear that clients or constituents will feel that they are being taxed for services that should have been provided by their own engineer. No county, city or state can today maintain an engineering force competent and expert in concrete arch design, but the taxpayers do not know it, and usually expect them to do it anyway. If expert designers are called in the local engineer may fear criticism and loss of his own fee or reduction in salary. This is particularly true of railroads and states which organize their own bridge departments, but who have never yet satisfactorily solved the problem of concrete arch design with efficiency.

The only remedy for such a condition is for the engineer in charge to permit the submission of alternate designs in advance of the letting, accessible to all bidders, the award then to go to the lowest bidder on the best design. This gives the purchaser the benefit of competition in design as well as in materials and enables his engineer to make selection from designs submitted by expert engineers through skilled contractors, a relatively easy matter compared with the problem of making his own design for an efficient structure. It seems at present the only way to put a stop to the wholesale waste that accompanies the practice in design of some engineers who profess to be concrete bridge engineers, but who in reality pose as such only because of the popularity induced for such structures by more efficient designers.

The number of steel bridges increased greatly during the period from 1880 to 1900 and as the life of steel bridges for highway service may be taken ordinarily at about thirty years we are now approaching the time when more and more failures of steel bridges are to be expected. Many of the earlier steel bridges were designed for wooden floors, and the expense of maintaining such floors has now become so burdensome that attempts are made to replace them with more permanent construction. But permanent floors are heavier and consequently endanger the bridge or compel its removal for a permanent bridge. It is not surprising, therefore, that the concrete bridge has become more and more popular and it is being built extensively even at prices far in advance of the cost of steel bridges.

Where this is done, however, it is usually by suppression of opportunity for competition by steel bridges and for this there is no occasion. The concrete arch bridge will win in fair competitions if only given the opportunity.

Refined Concrete Processes

For a good many years concrete was used merely as a rough material. During the last few years it has been used more or less as a decorating material. To be fully satisfactory for the latter, it is necessary that the concrete be properly handled and treated, and this requires an intimate knowledge of various formulas, methods and processes.

The Art Stone Co., Box 330, Waynesboro, Pa., have made a specialty of this branch of concrete work. They have developed processes and methods which are of great value to the concrete worker who wishes to secure the most artistic and beautiful effect. Those of our readers who are fortunate enough to visit the Chicago Cement Show each year have seen the work of this company on exhibit. Our readers should write to them direct for their special proposition to contractors and builders.

J. F. Benton Appointed Superintendent New Egyptian Cement Plant

J. F. Benton, who, for the past five years, has been on the road for the Kent Mill Company, has resigned to take the position of general superintendent of the New Egyptian Portland Cement Company, Fenton, Mich. Mr. Benton has had wide experience in cement mill work, having been twelve years in that field, serving with the Portland Cement Company of Durham, Ont., The Sandusky, Marquette, Universal and Piedmont. He also was in the service of the Lehigh Car Wheel and Axle Company for over three years, one of which was spent in Europe as superintendent of construction of the first American dry process plant in England erected by the Ship Canal Portland Cement Company of Ellsmere Port, Cheshire.

Asks Joint Cement Rate

Pacific Portland Cement Company, which operates a large plant at Cement, about ten miles east of San Francisco, applied to Commissioner Loveland yesterday for the establishment of a joint rate by the Tidewater Southern Railway, the Southern Pacific Company and the Cement, Tolinas and Tidewater Railroad, so that the cement company might compete at Stockton and elsewhere with the Cowell Lime and Cement Company.

This latter company, it appears, has secured already a joint rate through to Stockton.

The rate asked by the Pacific Portland Cement Company is \$1.15 from Tolinas to Stockton, and James A. Keller, traffic manager, introduced testimony yesterday that since March 5, 1917, his company had shipped 5,560,000 pounds of cement over the Tidewater and Southern Railway.

The present rate paid by the Pacific Cement Company to Stockton amounts to about \$1.90.

Cement Company Grants Increase

The Alpha Portland Cement Company, Easton, Pa., recently notified its employes, numbering 1,200, of a general advance in wages varying from six to ten per cent, to take effect October 1. This is the fifth voluntary increase in wages made by this company since December, 1915.



Concrete Houses Being Built for American Steel & Wire Company.

One Hundred Concrete Houses Just Completed at Donora, Pa.

The Lack of Proper Housing Facilities for Employees in Manufacturing Centers is Becoming So Pronounced that Manufacturers are Taking a Keener Interest in the Problem

A hundred concrete dwellings have just been completed in Donora, Pa. at the rate of one every three days. This brings to our mind vivid recollection of the public statement of Thomas A. Edison that he was going to pour a concrete house in an hour or so.

This accomplishment, made by the Aberthaw construction Company of Boston, Mass., establishes a record far above any similar performance, and it shows the possibilities when a contract of this kind is undertaken by a large reputable contractor with abundant equipment, financial resources and with a highly perfected organization.

The large contracting companies have made a specialty of rapid construction in the past and have been organized to do work with efficiency and dispatch. This, however, is the first case on record where one of these companies has applied the same methods to reproduction of a large group of smaller buildings.

Descriptions of Dwellings

The houses were built for the American Steel & Wire Company, being neat and attractive and of eight different styles. They contain 4, 5 or 6 rooms each with a bath and cellar. A few double houses were erected with party walls, but the great majority of them are detached. The average dimensions are about 26 by 26 feet. The 6-room houses contain living room, dining room and kitchen on the first floor, and three chambers and bath on the upper floor. The cost of the houses varied from \$2,000 to \$3,300, these prices including gas furnaces and cooking ranges, electric lighting and the usual improved kitchen and bathroom equipment.

All houses are of the box type with solid reinforced concrete walls 6 in. thick. There is a flat concrete roof and on top of this a spruce framing is built up covered with asbestos slate. This gives the houses a more artistic appearance than would otherwise be possible. The floors are of the ribbed reinforced concrete type, with the ribs or beams spanning between the outer and interior walls. In the cellar these ribs are left exposed,

but in the other floors plaster board is nailed to strips left in the concrete and finish plaster coat made.

Speed Possible Through Standardized Designs and Forms

The fact that this work was undertaken and accomplished with such speed and satisfaction was due to the application of methods used on large buildings to the building of 100 individual establishments. The designs were thoroughly worked out in the first place, and standardized steel forms and wooden forms were used on successive rows of houses.

The steel forms are of the special channel type patented by the Lambie Concrete House Corporation, and consist of 9-inch channels, which are set up vertically and are connected together with clips and wedges. Details of the forms are shown in the accompanying illustration. A 4 by 4-in. steel angle is set up at the corner of the building and the forms are lined up longitudinally by a steel channel used to form a belt course. This not only fastens the forms of the lower floor, but is bolted into the floor reinforcement and remains in place as a support for the second story forms. It is removed after all the concrete has been poured.

The houses were constructed in groups, a set of forms being used for a group and then taken down as quickly as possible and used for the next group. Usually the forms were set up for one story wall and floor together, and then concrete was poured for this section all at one time. To complete one story takes about seven days, and working at this rate a house of two floors and a cellar is completely concreted in three weeks, and with twelve sets of forms the same number of form houses are completed in this period. Subsequent to this, plumbing, heating, plastering, roofing and finishing must be completed, requiring about five weeks more. These twelve houses were completed in the first eight weeks and twelve every three weeks thereafter.



Styles of Concrete Houses Being Built for the American Steel & Wire Company.

Organization

On this job the organization consisted of a superintendent, assistant superintendent, civil engineer, material clerk, two cost clerks, timekeeper, planning department and stenographer. The formwork was under supervision of one carpenter foreman, five squad bosses, two stripping foremen, two move foremen, one reinforcing steel boss, one finish carpentry boss, three concrete bosses and one excavation boss.

It was found advisable to have a squad boss in charge of the carpenters and helpers working on each house. This boss had four carpenters and four helpers on the smaller houses; and on the large double houses, up to seven carpenters and seven helpers. The work has been most economically done when the carpenters and helpers worked in pairs—that is, each carpenter has a helper to assist him in moving the forms, etc. It will be noticed that the reinforcing steel boss comes under the carpenter foremen. This has been found desirable, as the steel must be placed rapidly whenever the carpenters are ready for it. The planning department on the job laid out progress each day for the next three days and showed which foreman was to erect



Showing Method of Construction.

forms on each house and which concrete gang would pour them.

In a concrete gang the number of men varied from 13 to 15, according to the type of house and the amount of concrete to be poured. The number of gangs at work at the same time is five carpenter gangs erecting forms, two concrete gangs concreting forms, two stripping gangs stripping forms, one concrete gang concreting footings, pavings, porch floors, floor steps, chimneys, one digging gang, and one finish carpentry gang, doing the furring, roof framing and roof boarding, erecting door and window frames, sash doors, inside and outside trim, stair laying, floors, etc.

On a large-type 6-room house group this force has taken approximately $1\frac{1}{2}$ days to erect basement walls and first-floor forms, including all boxes, window frames, flues, etc. Concreting basement walls takes about $2\frac{1}{2}$ hours, and $1\frac{1}{2}$ hours to pour the floor. Stripping and erecting the basement wall forms on the first story takes $1\frac{1}{2}$ to 2 days. The stripping of the first-story walls and erecting the second story and putting on the floor takes about $1\frac{1}{2}$ days, but the putting on of the cornice is a slower operation and adds from half a day to a day to this. Concreting the walls takes about $2\frac{1}{2}$ hours, and the roof about the same length of time.

Maintenance of Concrete Highways in Milwaukee County, Wisconsin

In 1916 about 1,000,000 sq. yd. of road surface was maintained at an expense of \$5,269.91, which included labor, materials, and machinery-depreciation. Of this amount, 923,483 sq. yd. was concrete, on which \$4,051.62 was expended or about 0.0044 per sq. yd. There was also expended about \$18,000 on shoulder-work, ditches, sewers, retaining-walls, and other miscellaneous items. No part of this sum is chargeable to road-surfacing.

Since 1912 the total cost of maintaining concrete-road surfaces was \$10,721.85. Of this amount \$4,822.82 was expended on 43,482 sq. yd. of surfacing that was not built according to modern methods.

Our method of repairing concrete highways is as follows: The surface should be first swept with a steel broom to loosen any dirt, after this the spot should be thoroughly swept with fibre street-brooms. To remove the fine dust which the steel brooms leave behind we use ordinary house-brooms, which leave the surface in fairly clean condition.

The depression is then covered with hot tarvia No. 9 and filled with coarse sand or screenings and opened to traffic. In case the depression is of considerable depth, or what might be called a hole, we would advise

one of two methods: First (in case you want to avoid delaying traffic), clean the depression as already described, and then paint it with tar. Then bring the surface to grade with crushed stone, being careful to have the greatest dimension of the stone less than the depth of the depression. Tamp the stone in place with hand-tampers or roll with a roller, if one is available, and fill the voids with a heavy bituminous road-binder, allowing about one gallon per square yard per inch in depth. The second method is to cut out the poor place and after trimming the hole and sprinkling the sides, fill with the same mixture as was used in the original road.

We consider it economy to have a small maintenance crew which goes once or twice each year over all the roads in the county. Such a crew consists of a foreman, one team, and four laborers. Under average conditions, this crew will cover the joints, cracks, and small pits in from one to two miles of 18-ft. road in one day at a cost of from \$15 to \$30 per mile for labor and materials.

*Extract from the fifth annual report of H. J. Kuelling, county highway commissioner, Milwaukee, Wisconsin.

Reinforced Concrete Pavement with Bituminous Block

By H. J. Hammer City Engineer, Gloversville, N. Y.

During the year 1916, 12,378 square yards of reinforced concrete pavement were laid in Gloversville, N. Y., by contract, under the direction of the writer. The different contracts were awarded for three lots of 1,555, 1,584 and 5,120 square yards at \$1.57 per square yard, and for two lots of 1,576 square yards at \$1.54 per square yard. Although the contracts were divided between two firms at the letting, the work was done by a single contractor. The above prices per square yard included excavation and grading. The construction work was started about the first of May and was completed in good season, with the exception of East State street, which was only about three-fourths completed on account of the cold weather, and none of the top was put on that part of the East State street pavement which was completed.

Most of the excavation for sub-grade was in dry, sandy and gravelly soil, but where wet soil was encountered it was underdrained with 4-inch vitrified tile drain laid with open joints surrounded with crushed stone. The under-drains were connected with the storm water sewer, which was laid in the street prior to the construction of the pavement, with catch-basins at all street intersections. The sub-grade was thoroughly rolled with a 10-ton steam roller.

One brand of cement was used on the entire job. Each carload lot was tested and approved by the Engineering Department. All fine and coarse aggregate was clean, hard limestone from a quarry about ten miles northeast of the city.

All the pavement was reinforced with triangular wire mesh, furnished by the American Steel & Wire Company, through the contractor. The reinforcement was placed 2 inches below the top of the finished surface of the pavement. All reinforcement was carried within two inches of all joints, but not across them and adjacent widths of the wire mesh were lapped 4 inches.

Transverse expansion and contraction joints were spaced 35 feet apart at right angles to the center line

of the pavement. Similar joints were placed adjacent to each curb. Elastic for the joints were composed of bitumen $\frac{3}{8}$ -inch in thickness and extending through the entire thickness of the pavement.

All concrete was mixed in a batch mixer of the Austin cube type, and the greatest care was exercised in having the ingredients of the concrete or mortar mixed to the

desired consistency and to maintain that consistency so that when the concrete was deposited in place the mortar and coarse aggregate would not separate. The concrete for the pavement was mixed in the proportion of one part cement, two parts of coarse sand and three parts of broken stone ranging in size from $\frac{1}{4}$ -inch to $1\frac{1}{2}$ inches. Immediately prior to placing the concrete, the sub-grade was thoroughly wet. The use of a header or bulkhead at the middle of the roadway, upon which to operate the template, was not allowed, thus avoiding a weak place in the center, but the template spanned the entire width of the roadway.

After the surface of the concrete had been struck off with a template, it was finished with a wooden float, the use of steel floats not being allowed. From twelve to twenty-four hours after the surface had been floated, depending upon the weather, it was thoroughly broomed with a stiff fiber broom so as to remove the film of cement and expose a good percentage of the surface stone. The pavement was then immediately covered with a thin layer of sand, which was kept moist by sprinkling for at least seven days. No traffic was allowed on it for twelve days after the finishing. The concrete pavement had a uniform thickness of six inches, and the crown was $\frac{1}{70}$ of the width of the pavement between curbs.

Before the application of the "Tarvia A" bituminous wearing surface, the concrete pavement was thoroughly cleaned by brooming and flushing. The bitumen was heated in a tar kettle and was applied by means of a pressure distributor at a temperature of 200 degrees F. and under a pressure of from 60 to 80 pounds to the square inch. The first coat of bitumen was applied at the rate of one-third gallon to the square yard. The principal advantage derived from the use of the pressure distributor, aside from getting an even distribution, was the fact that it drove the particles of dust from the pavement surface into the air. The dust then settled on top of the bitumen and became one of the

ingredients of the wearing surface rather than a separator between the concrete and the bitumen.

Screenings free from dust were applied from wagons which followed behind and at one side of the distributing machine, so that they fell into the bitumen while it was still warm. They were applied at the rate of about $\frac{1}{100}$ -ton per square yard. The following day the second



Laying the Triangular Wire Mesh Reinforcement for Concrete Paving in Gloversville, N. Y. All the Concrete was Mixed in a Batch Mixer of the Austin Cube Type.

coat of bitumen was applied in the same manner as the first, and screenings were immediately applied again at the rate of about 1/100-ton per square yard. The street was kept closed for twenty-four hours to allow the bitumen to adhere to the concrete, and was then opened for traffic. The total amount of "Tarvia A" used was 6,350 gallons, which would average applied 69/100 gallons to the square yard.

The specifications followed standard practice for concrete pavements. They required that of the fine aggregate "not more than 5 per cent shall pass a sieve having 100 meshes per lineal inch. Fine aggregate containing more than 3 per cent of clay or loam shall be washed before using." The coarse aggregate must "pass a 1½-inch round opening and be retained on a screen having ¼-inch openings." "Natural mixed aggregate shall not be used as it comes from deposits, but shall be screened and used as specified."

It was required that the sub-grade be consolidated by using a self-propelled roller weighing not less than 10 tons.

The concrete ingredients were to be mixed "until the cement is uniformly distributed and the mass is uniform in color and homogeneous." The concrete was specified to be of such consistency that, when deposited, it "will settle to a flattened mass, but shall not be

so wet as to cause a separation of the mortar from the coarse aggregate in handling."

The reinforcing metal was specified to have a cross-sectional area equal to 0.038 square inch per foot of pavement width and 0.049 square inch per foot of pavement length.

The concrete pavements which were constructed in Gloversville in 1916 have stood the winter well, and came out in good condition this spring. Last winter was one of the most severe, from the standpoint of pavements, that has been experienced in this section, the frost reaching to a depth of 4 and 5 feet. Some of the pavements laid in 1916 were on quite heavy soil, but even these have shown no signs of cracking. The carpet covering has not peeled and looks as good as the day it was applied.

The concrete pavements constructed in 1915 were laid under the same specifications as those built in 1916. These, too, have shown no signs of cracking and have undergone the test of two winters. A small part of the earlier pavements were laid on heavy soil. The carpet covering was also applied to these pavements when they were laid, at the rate of ½-gallon to the square yard. Not a fractional part of this top has peeled off, and from all appearance it is in just as good condition now as in 1915.

New Additions at the Oklahoma Portland Cement Plant and Crushed Stone Quarry

Announcement has just been made that the Oklahoma Portland Cement mills at Ada, Okla., are to be increased, making the production 4,500 barrels of cement a day instead of 2,500 as at present. This addition will be made as soon as the material can be bought. Just at present the market for steel is so congested that buying is almost an impossible task, the operators say. The market is being kept up with, however, and the new machinery will probably be on the ground before a great while.

The addition will consist of two large kilns 240 feet long. One will be used for raw grinding and the other for finished grinding. At present there are four kilns 124 feet long.

The Oklahoma Portland Cement plant was built in 1907 and the wheels began to turn about the time Oklahoma became a state. Since that time it has been successful though at first the matter of paying dividends was a proposition. The company was organized by A. L. Beck of Indianapolis, Ind., and J. M. Wintersmith of Louisville, Ky. These men, with their associates operated the plant until the latter part of 1916, when they sold it to the Central Securities Company of Denver, one of the largest cement manufacturing companies in America. Mr. Beck soon terminated his connection with the company, and the management was given over entirely to Mr. Wintersmith. Mr. Wintersmith is still general manager of the plant and is carrying out the ideas that built the business.

A year ago this company began the construction of a huge crushing plant at the rock quarries at Lawrence, seven miles south of Ada. They purchased a 36x72 in. jaw crusher from the Traylor Engineering & Mfg. Co. of Allentown, Pa. This crushing plant is now complete and running. It is the largest rock crusher west of the Mississippi, having daily capacity of 3,000 yards,

or seventy-five car loads of crushed rock. Rocks as large as five square feet and seven feet long can be ground between the big jaws of the crusher with seemingly little effort. The fly-wheel of the engine weighs thirty tons, and when this once gets started rocks have little effect upon its speed.

Machines Do the Work

This crusher has need for only a few men, machinery doing most of the work. The limestone that is used is found near the surface of the ground, in fact, covers scores of acres. Steam drills, made by the Sanderson Cyclone Drill Co., Orville, Ohio, sink holes in the solid rock. Dynamite blows them apart. Steam shovels pick up the hills of rocks, and trains convey them up an elevated railroad track and drop them into the mouth of the jaw crusher. The rock is crushed, conveyed by power operated conveyers to still another crusher. After the rock is crushed here, it is conveyed into the storage house. Cars are placed under the storage house and the crushed rock pours into them. It takes only a dozen men to run this plant, which handles seventy-five carloads of rock a day.

The crushed rock is used for two purposes—for cement and for ballasting. The stone for the cement is shipped to the cement plant in Ada and ground into powder. The other has been contracted for by the Frisco railway and will be used in ballasting the road-bed from Sapulpa to the Red river.

The officials of the cement company take great pains to provide for the comfort of the employees. A large building is now under construction which will be used exclusively by the workmen. It will be equipped with lavatories, shower baths, lockers and comfortable rest rooms. There has never been any trouble of any nature between the officials and the workmen.



The Employment of a Well Drill and a Steam Shovel Simplifies the Method of Obtaining Material for Crushers and Kilns.

The Advantages Derived from the Well Drill in Quarry Operations

It was only a few years since the advent of the well drill in quarry operations. Its use has increased by leaps and bounds and daily quarry operators are adopting it. No one nowadays questions the success of the big drill and its superiority over the air or steam drill of tripod type.

Universal interest has been created by the automobile in good roads. This, with the tremendous increase of steel and concrete in building and engineering operations, has caused a great demand for crushed stone for road mineral, cement manufacture, lime making and blast furnace flux, etc.

The well drill, along with the big crushers and the steam shovel, has been an important factor in making it possible to supply this demand. The introduction of big machinery has revolutionized quarrying and other rock excavating operations.

The well drill is proving more economical, efficient and convenient than the old type of drill. It is best suited where the stratification of the rock permits and the height of the face is more than 25 feet.

It has been found from observation that the cost of drilling bore holes with the ordinary tripod drills varies from 10 cents to 25 cents per foot. This wide variation of cost depends on the character of the rock, cost of labor, fuel, oil, etc., number of drills in operation and the accessibility to source of power, water, etc. The fewer the drills in operation, if run from a central power plant, the higher will be the cost per foot.

In rocks of medium hardness, such as limestone, a man working industriously should average from 40 to 60 feet of bore hole per ten-hour day. The cost of drilling such rocks will seldom fall below 15 cents per foot, in a quarry operating several drills. In harder rocks, such as traps, syenites, granites, etc., from 20

to 30 feet is an average day's work, and the cost will be made from 20 to 25 cents per foot.

The cost of drilling a 5½-inch bore hole with a well drill may vary all the way from 20 cents to 60 cents per foot. In several operations the cost per foot is less than 30 cents. A good operator and helper in ordinary limestone, where strata are flat and other conditions favorable, can make from 20 to 60 feet per ten-hour day.

In very hard rocks, such as traps, granites, etc., from 15 to 25 feet a day should be considered a fair day's work.

It is fair to assume 25 feet per day and 30 cents per foot as an average cost for well drilling.

In the following table are given the number of cubic yards of rock displaced per foot of bore hole at different spacings.

Relative Costs of Steam Drilling and Wet Drilling

Assume for comparison 180 feet of drilling with each type of drill. The relative cost, assuming 15 cents per foot for steam drilling and 30 cents per foot for well drilling, would be:

Steam Drill:

Drilling 180 feet @ 15 cents = \$27.00.

At 7 x 7 spacing = 1.81 cubic yards per foot.

Nine 20-foot holes = 180 feet × 1.81 = 325.8 cubic yards.

About 140 pounds of dynamite would be required.

140 pounds @ 12.5 cents per pound = \$17.50.

Total cost: \$27.00 + \$17.50 = \$44.50.

Cost per yard: \$44.50 ÷ 325.8 cu. yds. = 13.6 cents per cu. yd.

An average cost when three 60-foot well-drill holes are blasted is about as follows:

Drilling: 180 feet @ 30 cents = \$54.00.

At 20 x 20 spacing = 14.81 cubic yards per foot.
Three 60-foot holes = 180 feet × 14.81 = 2,665.8
cubic yards.

About 1,350 pounds of dynamite would be required.
1,350 pounds @ .125 cents per pound = \$168.75.
Total cost: \$168.75 + \$54.00 = \$222.75.

Table Showing the Number of Cubic Yards of Rock Displaced Per Foot of Bore Hole at Different Spacings
. Distance Between Bore Holes
Distance of Bore Holes Back From Face

	5 ft.	6 ft.	7 ft.	8 ft.	9 ft.	10 ft.	11 ft.	12 ft.	13 ft.	14 ft.	15 ft.	16 ft.	17 ft.	18 ft.	19 ft.	20 ft.
5	.92	1.11	1.3	1.49	1.66	1.85	2.04	2.22	....	....	....	....	....	....	....	....
6	1.11	1.33	1.55	1.77	2.0	2.22	2.44	2.65	....	....	....	....	....	....	....	....
7	1.3	1.55	1.81	2.0	2.33	2.7	2.85	3.11	....	....	....	....	....	....	....	....
8	1.49	1.77	2.0	2.37	2.65	2.96	3.26	3.55	....	....	....	....	....	....	....	....
9	1.66	2.0	2.33	2.65	3.0	3.33	3.66	4.0	....	....	....	....	....	....	....	....
10	1.85	2.22	2.7	2.96	3.33	3.7	4.1	4.44	4.81	5.18	5.55	5.92	....	....	....	....
11	....	....	....	3.26	3.66	4.1	4.48	4.88	5.3	5.7	6.11	6.52	....	....	....	....
12	....	....	....	....	4.0	4.44	4.88	5.33	5.77	6.22	6.66	7.11	....	....	....	....
13	....	....	....	....	....	4.81	5.3	5.77	6.26	6.74	7.22	7.70	....	....	....	....
14	....	....	....	....	....	5.18	5.7	6.22	6.74	7.26	7.77	8.30	....	....	....	....
15	....	....	....	....	....	5.55	6.11	6.66	7.22	7.77	8.33	8.88	9.44	10.0	10.55	11.11
16	....	....	....	....	....	....	....	7.11	7.70	8.30	8.88	9.48	10.07	10.66	11.3	11.85
17	....	....	....	....	....	....	....	7.55	8.18	8.81	9.44	10.07	10.70	11.33	11.96	12.59
18	....	....	....	....	....	....	....	8.0	8.66	9.33	10.0	10.66	11.33	12.0	12.66	13.33
19	....	....	....	....	....	....	....	....	9.15	9.85	10.55	11.3	11.96	12.66	13.37	14.07
20	....	....	....	....	....	....	....	....	9.63	10.37	11.11	11.85	12.59	12.33	14.07	14.81
21	....	....	....	....	....	....	....	....	....	....	11.66	12.44	13.22	14.37	14.77	15.55
22	....	....	....	....	....	....	....	....	....	....	12.22	13.03	13.85	14.66	15.48	16.30
23	....	....	....	....	....	....	....	....	....	....	12.78	13.63	14.48	15.33	16.18	17.03
24	....	....	....	....	....	....	....	....	....	....	13.33	14.22	15.11	16.0	16.88	17.77
25	....	....	....	....	....	....	....	....	....	....	13.88	14.81	15.74	16.66	17.60	18.51
26	....	....	....	....	....	....	....	....	....	....	14.44	15.74	16.37	17.33	18.30	19.26
27	....	....	....	....	....	....	....	....	....	....	15.0	16.15	17.0	18.0	19.0	20.0
28	....	....	....	....	....	....	....	....	....	....	15.55	16.6	17.63	18.52	19.7	20.74
29	....	....	....	....	....	....	....	....	....	....	16.1	17.18	18.26	19.33	20.4	21.48
30	....	....	....	....	....	....	....	....	....	....	16.66	17.77	18.88	20.0	21.1	22.22

To reduce to tons:
For limestone multiply by.....2.27
For traps, syenites multiply by.....2.52
For granites multiply by.....2.3
For shale multiply by.....2.18
For glass, sand or gravel multiply by.....1.55



Blasting Down the Face of a Quarry in Alabama.



Results Obtained with Du Pont Explosives in an Oregon Quarry. Bore Holes Loaded with 560 Kegs Blasting Powder, Detonated with 40% N. G. Dynamite Primer Containing No. 6 Electric Blasting Caps.

Cost per yard: $\$222.75 \div 2,665.8 \text{ cubic yards} = 8.4$ cents per cubic yard.

Labor Saving Effected by Use of Well Drill

The advantages of the well drill over the piston-driven drill are numerous. By carrying the bore holes the full depth of the face, the stone is loaded and treated on one working floor. It is unnecessary to employ a gang of men to bar down and clean off benches after the shot and to lift and lay tracks so frequently.

A quarry where 15 men had been used for this purpose, dispensed with them upon the adoption of the well drill.

Loading operations are less frequent, thus lessening the danger. Stone can be shot down in greater volume and in better shape, making it economical to use a steam shovel. No bench cleaning to do makes it safer for the men. It is cheaper and can be used in outlying and temporary operations where the cost of installing a power plant would be out of the question. It permits of a greater spacing of bore holes and eliminates necessity of "squibbing" or springing.

"Springing" Bore Holes Not Required

It is probable that the well drill will reduce quarry costs in this way more than by reducing the explosive cost per yard or ton blasted, the saving being shown in general quarry costs. In all blasting the object to be attained is maximum breakage at least cost. The greater the proportion of one-man-stone after a blast the better the shot.

In limestone quarries where stone is used for fluxing or lime making, spawls are practically waste. Too many fines are a serious obstacle in almost all stone operations, as the supply is greater than the demand. An ideal blast is one where the least amount of secondary drilling and blasting on the floor is required.

Production Costs Dependent on Careful Selection of Explosives

The question of the selection of explosives in obtaining the desired results is of great importance in quarry

operations. Each superintendent should give the matter close attention. Explosive cost is one of the big items in the production of stone, and, generally speaking, little or no attention has been given to this important problem. It is worth while to consult an experienced engineer or explosive manufacturer if your cost is too high or results unsatisfactory.

The cost per pound of explosive is not necessarily the same as the explosive cost per yard of stone. A large operation producing limestone for furnace flux made a 25 per cent saving in explosive cost mainly by changing method of the rock drilling and the handling of explosives.

All Explosives Are Not Alike

There are a great many explosives manufactured, nearly all of which differ in some way. Some are slow, others quick, some dense, others bulky. Conditions differ so much in actual practice that the choice of the proper explosive for a certain class of work sometimes requires considerable patient labor and experimenting. Some explosives are especially adapted to hard, dense rocks and others to the lighter and seamy stratification. Some are suited to wet conditions and others only to dry conditions.

Low Freezing Explosives Recommended

During the last few years, low freezing Straight, Extra and Gelatin dynamites have been introduced. These explosives do not differ in action from the high freezing ones and are just as efficient. Ordinary dynamite freezes at about 45 to 50 degrees F. Thawing explosives in winter is expensive, dangerous and tedious. The use of low freezing or non-freezing explosives will meet almost any condition and are strongly recommended.

Experienced Quarrymen Favor Large Bore Holes

It has been found by experience that it is just as cheap to drill a 5 $\frac{5}{8}$ -inch or 6-inch bore hole as one of smaller bore. The larger bore hole has the advantage of permitting a wider spacing and a better concentration of the explosives at the bottom, where it is usually most needed.

It also requires the use of a heavier stem and drill bit, lending rigidity and steadiness to the machine and minimizing break-downs. Squibbing or springing well-drill bore holes is not recommended. It is a slow, tedious and expensive operation and is fraught with more or less danger. It is far better to reduce the spacing of bore holes than to resort to springing.

If the rock is very hard and the tow heavy or bottom hard to pull, oftentimes better results can be obtained by using an explosive of greater density, such as gelatin, in the bottoms.

The following table gives the number of pounds of various explosives which can be loaded per foot in bore holes of different diameters, if the cartridges are slit and well-tamped.

Quantity of Explosives Which Can Be Loaded Per Foot in Bore Holes of Different Diameters—Cartridges Slit and Holes Well Tamped

Diameter of Hole— Inches.	Du Pont or Red Gelatin— Cross Lbs.	Straight— Du Pont Lbs.	Red Cross Straight or Du Pont Quar- ry—Lbs.	Extra— Red Cross Lbs.	Extra— Du Pont Lbs.	R. P.— Du Pont R. P. Lbs.	Powder— Blasting Lbs.
3	4.25	3.75	3.68	3.60	3.72	3.25	3.00
3½	5.68	5.10	5.0	4.89	5.07	4.42	4.08
4	7.55	6.60	6.53	6.33	6.62	5.72	5.28
4½	9.35	8.40	8.38	8.06	8.38	7.28	6.72
5	11.80	10.50	10.2	10.08	10.35	9.10	8.40
5½	14.94	13.2	12.8	12.53	13.0	11.3	10.44
6	17.0	15.0	14.7	14.4	14.9	13.0	12.0
6½	19.5	17.5	17.25	16.8	17.49	15.2	14.0
7	23.1	20.4	20.0	19.6	20.28	17.7	16.3
8	30.2	26.7	26.13	25.6	26.49	23.1	21.4

Proper Spacing of Bore Holes

There is no hard-and-fast rule for the proper spacing of bore holes. All depends on the local conditions. With a 5½-inch bore hole, which is more commonly used, it is advisable at first not to exceed 20 ft. x 20 ft. in limestones. In harder rocks it is well to begin with closer spacing than this at first, say 15 ft. x 15 ft. It is a good plan to begin low and work up. Many times when poor results are attributed to the explosive or system of drilling it is found that the fault lies in poorly placed bore holes, making an unbalanced blast. This is a subject requiring study by the quarryman to suit each local condition. As a general rule, the bore holes should never be drilled more than 20 feet apart. The distance back may vary according to character of rock and method of loading. Bore holes should be drilled from three to five feet below the quarry floor unless there is a natural parting at that level in which case, if they are drilled to grade, bottom will come clean. Going below floor insures better breakage, cleaner floor and permits of easy access for a steam shovel if used.

No rule can be given as to the amount of explosives to use in bore holes of given depths. The important part is the selection of the proper explosive to produce the desired result. When the proper selection is made, knowing the spacing and the number of bore holes, by referring to tables on pages 12 and 15 the amount of explosives required and volume of rock to be removed can be easily ascertained.

As a general rule a bore hole of any depth should be filled at least half of its length with explosive. A 40-foot bore hole should have 20 feet of explosive, a 60-foot bore hole 30 feet, and so on.

Location of Charge

In order to obtain maximum breakage and proper distribution of the explosive in the bore hole, the top

of the charge should be at least 30 feet from the mouth of the bore hole, no matter what its depth. General practice shows it is best to load to within 20 feet of the surface in hard material. It is absolutely essential in order to obtain maximum results in blasting that the force be properly distributed.

In loading deep bore holes there is nothing gained by loading the explosive loose; that is, removing the paper shells. In fact, it is more dangerous to do so, as loose explosives may be scattered all along the walls of the bore hole and at the mouth. When this occurs, there is always danger of a stone working loose and becoming wedged between the tamping block and wall, causing friction and setting off the charge.

Various Sizes of Cartridges Now Available

Explosive manufacturers today put up explosives in cartridges of almost every size up to 5 inches in diameter. The quickest and safest way is best. Simply slit the cartridges longitudinally on two or three sides, dropping each cartridge separately until about 25 pounds have been loaded, and then tamp lightly with a wooden tamping stick. This may be increased to 50 pounds as you approach the top of the charge.

Bore Holes Should Be Tamped Thoroughly

The fall, especially when large cartridges are slit, will cause the explosive to practically fill the bore hole. Bore holes have been loaded where the powder was not tamped, blaster depending on the explosive to tamp itself by the fall. With some explosives very good results are obtained in this way, but it is well to tamp all, as the closer the confinement the better.

All the water possible should be removed from the bore holes before loading is started. If loading is done in cold weather, care should be taken to see that explosives are properly thawed.

Combination of Two Explosives Recommended

In hard rocks a combination of 60 per cent and 40 per cent dynamite is recommended. A little 60 per cent should be loaded in the bottom of each bore hole and 40 per cent on top. In soft, flat limestone a 40 per cent explosive will usually be found strong enough, unless the spacing or the toe is heavy. If very wet and a heavy toe, a gelatin dynamite from 40 per cent to 60 per cent is recommended.

Position of Well-Drill Bore Holes

As a usual thing well-drill holes are driven and blasted in one line, the bore holes being equi-distant from the face. All the stone is then removed before the next blast is made. Occasionally, in very hard material better results are obtained by staggering the holes.

There is also another method of drilling and blasting known as shooting against the bank, or "buffer" shooting. By this is meant that a line of bore holes is shot down and then another line back of that is blasted before any of the debris from previous shot is removed. The first lift acts as a buffer to the second blast. This method is particularly well adapted to limestone formations in which the stone is flat and thinly laminated or disintegrated on top, and the face does not exceed 40 feet in height. It is only necessary to loosen the bottom in such a formation. "Buffer" shooting eliminates necessity of moving shovel as often as when clear bank method is used or lifting and laying tracks so frequently. Care must be taken not to load too high when this method is used, as often the break back makes it difficult to drill the next line of bore holes.

Strong Detonators Required for Best Results

Always use strong detonators, at least No. 6 Electric Blasting Caps, and, better still, No. 8. In all holes at least two detonators should be used. A good rule to

follow is to place a detonator every 25 feet in the explosive charge. If it is necessary to splice extra lengths to electric blasting cap wires, the joints should be carefully twisted, but not opposite or touching each other, and well taped. The use of sufficient primers serves the double purpose of assuring a thorough detonation of the explosive charge and also affords a way out in case one or more should be broken or otherwise damaged during tamping.

Dropping Cartridges in Bore Holes

In loading bore holes of extreme depth, the question might arise: "Is it safe to drop dynamite of, say 60 per cent or 40 per cent strength such a distance?" Usually there is some water at the bottom of the bore hole, and the cartridges being slit, the dynamite does not receive a very hard shock when it reaches bottom. The water also serves as a cushion and, when above the water, the explosive already in the bore hole serves the same purpose. If, however, any hesitancy is felt about dropping dynamite in this way, the first few feet of bore hole can be loaded by attaching a sharp stick or spear to the end of a string, inserting the stick in a cartridge, and lowering almost to the bottom of the bore hole; then release the cartridge with a quick jerk of the string.

The Proper Kind of Tamping Block to Use

A tamping block should be of wood about 4 feet long, and just enough smaller in diameter than the bore hole to have good clearance. Do not use a block too small in diameter, as there is danger of loose stones falling in the bore hole and getting wedged between the block and the walls, causing trouble and anxiety. The tamping block, if necessary, can be weighted by boring a hole about $1\frac{1}{2}$ inches in diameter at the bottom for about half its length and nearly filling same with molten lead or babbitt, and closing the hole with a wooden plug. By weighting the block in this way it is possible to tamp the explosive better at the bottom of the bore holes, where usually will be found some water. A rope should be fastened at the other end by boring a hole through the block from side to side and grooving above each end of the hole to the top of the block so that the rope will not project beyond the perimeter of the block.

For very deep bore holes a light tripod can be built and the tamping block operated by two men with the rope running through a pulley at the apex. This keeps the rope in the center of the bore hole and is easier for the men than lifting by hand. Another good arrangement is a heavy block shaped like a bootjack, with a pulley at the slotted end. This end is simply placed over the center of the bore hole and the rope is allowed to run over the pulley.

Tamping with the drill stem by screwing a wooden block on the end is extremely dangerous and should never be allowed.

The use of any metal parts in tamping is condemned by all authorities and a great many accidents have been caused in this way.

After each bore hole is loaded with the explosive charge it should be filled clear to the mouth with clay, sand or screenings, and tamped, care being taken to not break the insulation of the electric blasting cap wires or cordeau if used. Sand is the safest material to use for tamping large bore holes.

Approximate Amount of Stone Per Pound of Explosives

Below is given briefly the record of some blasts made in different sections of the country. An average of four to six tons of stone per pound of explosive is about what should be expected in blasting deep bore holes.

A blast in a limestone quarry in Tennessee, stone used for ballast and commercial purposes, consisted of sixteen $5\frac{5}{8}$ -inch bore holes, average depth 75 feet. Holes were spaced 18 feet apart, with average face burden of 22 feet. 3,750 pounds of 60 per cent and 3,700 pounds of 40 per cent. Low freezing dynamite was used in the blast, producing 5.7 tons per pound of explosive.

A blast in cement rock in Pennsylvania consisted of fourteen $5\frac{5}{8}$ -inch bore holes, average depth 86 feet, spaced 18 feet apart, with a face burden of 30 feet. 4,850 pounds of 60 per cent and 3,250 pounds of 40 per cent were used, producing 55,000 tons, or 6.8 tons per pound of explosive.

A blast in a Kentucky limestone quarry, stone used for ballast, consisted of nine bore holes, average depth 50 feet, spaced 18 feet apart and 25 feet back. 3,250 pounds of 40 per cent dynamite were used, producing 16,200 tons, or 5 tons to the pound of explosive.

A blast made in an Oklahoma quarry, where stone was used for railroad ballast, consisted of 8 bore holes 95 feet deep, average space between holes 28 feet, with average face burden 33 feet. 2,200 pounds of blasting gelatin, 3,350 pounds of 60 per cent and 1,250 pounds of 40 per cent dynamite were used. A total of 6,800 pounds producing 62,000 tons, or 9 tons per pound of explosive. This blast was badly balanced, necessitating use of very strong explosive at bottom. The cost per ton was just as high or higher than a balanced blast.

A blast made in iron ore consisted of twenty-six $5\frac{5}{8}$ -inch bore holes of average depth of 84 feet. Spacing 15x15 feet. Holes were triple loaded and fired with cordeau and one electric blasting cap. 8,500 pounds of 40 per cent dynamite were used, producing 50,000 tons of ore, or 5 tons per pound of explosive.

A blast made in cement rock in New Jersey consisted of 11 bore holes, average depth 102 feet. Spacing 20x22 feet. 2,040 pounds of 60 per cent. Gelatin and 4,475 pounds of 40 per cent. Gelatin were used, producing about 40,000 tons of stone, or 6 tons per pound of explosive.

A blast made in a West Virginia quarry, stone used for ballast, consisted of seven bore holes, average depth 60 feet. Spacing 18x20 feet. 1,600 pounds of 50 per cent. Gelatin and 1,200 pounds of 33 per cent. Extra Dynamite were used, producing 13,000 tons of stone or 4.6 tons per pound of explosive.

Precautions to be Observed

The following rules should always be enforced:

Permit no smoking in the vicinity of the loading operations.

See that the men assisting in the work have no matches—especially friction matches—in their coat pockets. There is a chance of these falling into the bore hole while loading, and the result might be disastrous.

Do not allow loose powder to accumulate around the mouth of the bore hole. Cleanliness is important.

The nails in the sole of a man's shoe may cause sufficient friction to set the charge off. In a dynamite manufacturing plant no one wearing a shoe with nails in the sole is allowed in any of the buildings.

Do not bring all the explosive for the blast on the job at one time, and do not allow it to stand out in the open over night.

If possible, complete the loading and firing in one day. If it takes more than one day to load the bore holes, make no connections until just before firing. When left over night, bury the ends of the electric blasting cap wires with earth. An electric storm during the night has been known to set off a blast.

The Design and Construction of a Reinforced Concrete Covered Reservoir

The reservoir described in this paper was built at Mankato, Minn., in 1916. It is circular, 100 feet in diameter and 25 feet deep, with a capacity of $1\frac{1}{2}$ million gallons, and is covered with a conical-shaped reinforced concrete roof. It was built on a hill composed of red and blue clay. The floor is about 17 feet below the original ground line and the filling around the walls extends to the height of the high water line, which is about 8 feet above the original ground line.

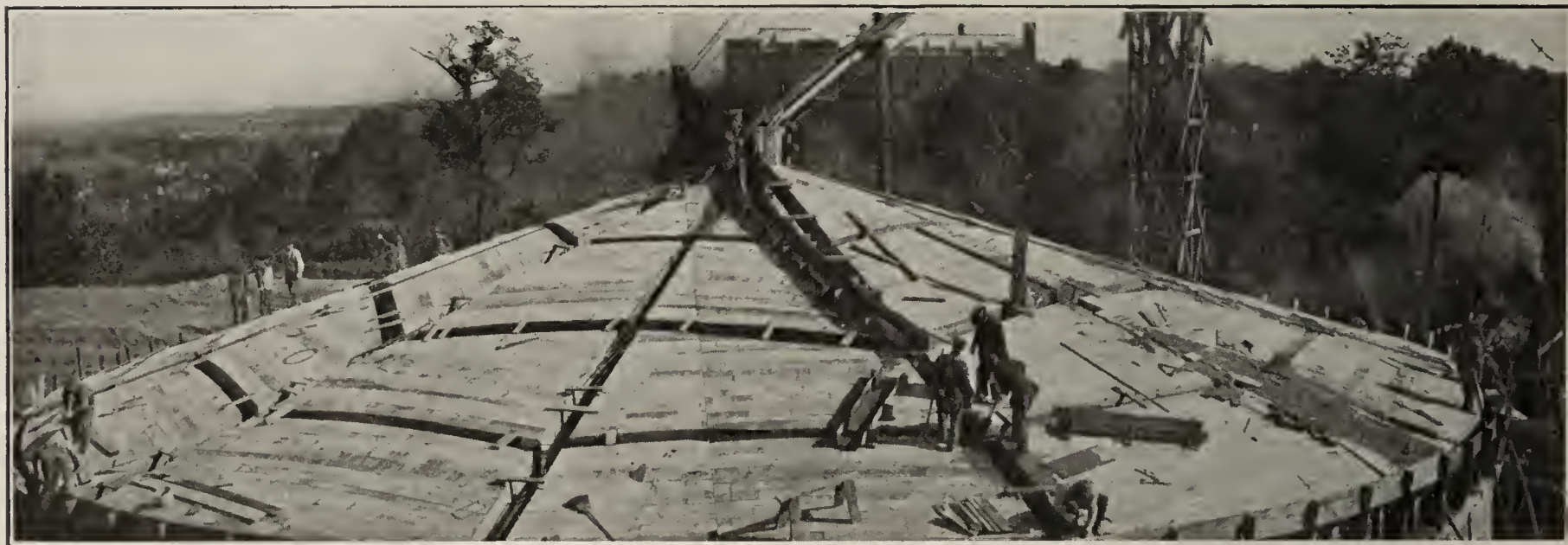
Special attention is called to the following features: 1. The circular plan. 2. The amount of horizontal reinforcement in the walls and the consideration given the earth pressure on the walls to offset the tension due to the inside water pressure. 3. The conical roof instead of a flat slab. 4. Expansion joints between floor and wall. 5. The provisions made for cleaning.

Circular plan. Where a reservoir is built entirely in solid ground and the outside earth takes the pressure of the water against the walls, no reinforcement is necessary because of this pressure and a square or rectangular plan will somewhat reduce the cost of con-

adopt in all cases where space will permit its use.

Where a covering over a reservoir is desirable, the cheapest construction, if concrete is used, undoubtedly is a flat slab; it may, of course, have pitch to provide proper drainage. The method of supporting the roof will depend on the depth, size and shape of the reservoir. If the reservoir is not deep, a large number of pillars from the bottom will reduce the size of beams, and vice versa. To find the most economical construction, each case must be studied by itself. There will always be a certain length of span at which the cost of construction will be the minimum. The most economical condition must be found by trials and estimates in each case.

There are instances, however, when economy must give way to some other desirable features. Too little attention has been paid in this country to the aesthetic features of permanent structures. In the use of concrete, the general appearance of a structure may be greatly improved at very little cost above a strictly economical design. In this case, after some considera-



Roof Centering in Place. Pouring a Roof Beam.

struction because of less expensive centering. But when the reservoir is empty, the earth pressure on the outside will create stresses in the walls opposite to those caused by the inside pressure when filled. For this reason reinforcement is necessary to take care of this negative stress, unless some other means is provided, such as a gravity wall or other form of construction.

If horizontal tension in the walls is to be taken care of by reinforcement, the circular wall requires the least amount for a given internal pressure. It will also counteract the thrust of the outside earth against the walls when the reservoir is empty without producing tension in any part of the walls. It may be said in passing that the outside thrust against the walls in some instances may be very large, especially if the earth has been saturated by water from leakage or other causes.

The circular types of construction cost more per cubic yard than the square or rectangular, but the saving in reinforcement and in volume of concrete or masonry is sufficient to offset the differences in cost. Therefore I believe the circular plan is the better to

tion to the aesthetic side of the result, it was decided that the most desirable covering was a conical shaped concrete roof supported by reinforced concrete beams inclosed with a curtain wall above the top of the wall proper. The roof rests on the outside walls and seven pillars, one placed in the center and six in a circle 60 feet in diameter around the center pillar, making the longest beams 30 feet in horizontal length between centers of support.

The roof slab is $4\frac{1}{2}$ inches thick, being 4 inches of 1-2-4 concrete and $\frac{1}{2}$ inch of mortar coating troweled to a smooth, hard finish. The roof slab is reinforced with $\frac{3}{8}$ -inch steel rods 8-inch centers laid one way only, and with a network of steel wire netting of 4-inch mesh with double No. 8 wire longitudinally and No. 12 $\frac{1}{2}$ crosswise. The amount of reinforcing is sufficient to carry a loading of 100 pounds per square foot of surface, besides its own weight. The roof beams are arranged about 12 feet apart.

In the design of the roof slab no consideration was given to the arch action of the slab due to the conical shape of the roof. This is a variable amount at different places of the roof, and while it would be suffi-



Framework for Roof Beam. Beneath May Be Seen Support for Roof Centering.

cient to consider in calculating the amount of reinforcement, it was not taken into account; its value will therefore go toward increasing the factor of safety.

The necessary amount of horizontal reinforcement in the walls, depending upon the amount of earth pressure that may safely be taken to neutralize the stress due to the inside water pressure, will of course depend on the nature of the ground and the care exercised in filling around the walls after the forms are removed. With care in refilling the clay soil, the earth thrust ordinarily is more than sufficient to counteract the pressure due to water extending from the surface of the ground to a given point in the wall. There would, however, be certain times when the upper layer of the earth, say the surface layer about 6 feet thick, would not act as a support to the walls, because, during very dry condition of the ground, contraction takes place in it so that it recedes from the adjoining surfaces. This is also true in very cold weather when the ground freezes.

For this reason no support from the upper 6 feet of the ground surface should be assumed. In our design the horizontal reinforcement in the upper 15 feet of the wall is sufficient to take the entire tension due to the inside water pressure at a unit stress of 16,000 pounds per square inch, with a surplus amount near the top to take care of ice thrust in case of ice formations on the water. The reinforcement in the lower 10 feet of walls is not sufficient to take all the tension at 16,000 pounds as a unit stress. About 40 per cent of the tension is here assumed to be taken up by the outside earth thrust, and with no tension being assumed in the concrete it is safe to assume the design has the proper factor of safety.

The floor consists of 10 inches of concrete reinforced with $\frac{3}{8}$ -inch rods laid both ways 9 inches apart. The floor was constructed after the walls and roof had been completed. A $\frac{3}{4}$ -inch expansion joint connects the floor and walls, also the floor and pillars. This joint was calked with oakum, and filled with an asphalt filler.

The floor slopes from the walls toward the center, being 18 inches lower at the center than at the walls.

Method of Construction

On account of the firmness of the ground, it was intended to trim up the sides after the excavation had been made so that no outside forms would be necessary for the walls below the surface of the ground. But hard rains during the time of excavation caused some slides to occur so that forms were needed for about half of the walls.

After the excavation had been completed, we built the forms for the entire wall and the six large roof beams radiating from the center, also the supports for the centering of the roof, before any part of the wall, except the foundation below the floor line, had been poured. The reinforcement was placed in the wall at the time of building the forms, and was supported by two 2-inch angles laced together for this purpose. These supports rested on the concrete foundation already poured for the walls, and were placed at intervals of $10\frac{1}{2}$ feet and carried the entire horizontal reinforcement. These angle supports, together with $\frac{3}{4}$ -inch rods 2 feet apart, form the vertical reinforcement of the walls.

All the concrete for the entire structure, except for the foundations and the floor, was distributed from the hopper at the center of the roof, the radiating forms for the roof beams acting as chutes to different points around the wall.

The mixer was placed in a pit below the surface of the ground near the wall and the concrete hoisted in a tower about 60 feet above the surface of the ground, from which it was run through an inclined chute to the hopper at the center of the roof.

All the material was on the ground before pouring of the walls was commenced, because they were to be poured in a continuous operation to avoid horizontal seams forming where concrete would set between pourings if done intermittently. The sand and crushed stone was taken from the material bins to the mixer in dump cars.

The pouring of the walls was done in four days and four nights without stopping the mixer at any time for more than one hour, and the concrete deposited at different points around the wall in rotation so that no part of the surface had set before new concrete was added. Small openings in the forms were left for working the concrete in the walls to prevent voids, and these were closed up as the filling progressed.

The walls are 24 inches thick at the bottom and 15 inches at the top.

After the walls had been completed, the forms for



Pouring Roof Slab by Chute from Tower.

the roof beams were cleaned and completed and the centering laid for the entire roof slab before the beams were poured. The centering for the roof slab was all supported by staging from the bottom. The form work, centering and supports for roof beam and slab required about 100,000 feet of lumber, but the greater part of this did not require cutting, and therefore the waste was not more than about 15 per cent.

The reinforcement was then placed in the beams and all the beams and curtain wall poured. After the beams had been completed, the reinforcement was placed for the roof, and the concrete afterwards poured. The concrete was mixed sufficiently stiff to prevent sliding or running when placed on the inclined roof, which has a rise of 15 feet in 50. The roof slab was finished with a $\frac{1}{2}$ -inch mortar surface trowled to a hard, smooth finish.

The mixture of the concrete in the foundations is 1-2-5, and of all the walls, roof and floor is 1-2-4. Crusher-run limestone passing a 2-inch ring was used for the coarse aggregate. As an aid toward waterproofing the concrete in the floor, walls and roof slab, 20 pounds of hydrated lime was used with each barrel

of cement used, the lime being first thoroughly mixed with water.

For waterproofing the concrete surfaces, two plastering coats were applied, consisting of 1 to 2 cement mortar to which was added Truss-Con Waterproofing Compound, and then the surfaces given a brush washing of cement grout.

Provisions are made for draining out all the water in cleaning, and since there is a separate system of water supply for the hill district, a 4-inch pipe line from this system was laid into the reservoir and provided with a $2\frac{1}{2}$ -inch fire hose nozzle so that a fire stream of 60 pounds pressure may be used for cleaning.

The reservoir has been in use about two months and no visible leakage has so far taken place.

The work was done by the J. B. Nelson Construction Company of Mankato under contract at a cost of \$19,373.

The new reservoir is used in conjunction with the old masonry reservoir of about 800,000 gallons capacity, and was constructed primarily for the purpose of increasing the storage capacity of the waterworks system for fire protection.



Four-Ton Dump Motor Truck as Operated by the Eighth Avenue Sand & Gravel Co., Seattle, Wash.

The Cost of Motor Trucking

The efficient use of time is an essential to the success of the contracting business. Men and materials must be collected and elaborate preparations must be made to start the ball rolling at a specified hour, and from the moment the work is begun, any time wasted, lost, or inefficiently expended means direct loss of profit to the contractor. The contracting end of building and construction work has, therefore, a special appeal to active men, hustlers, live wires who know how to keep things moving on the job, for they know that with cost of labor and materials fixed and determined beforehand time is the only element left for them on which to expend their ingenuity.

Contractors were among the first to recognize the time-saving features of motor-truck service. The motor truck fits into the contracting business, just as the automobile and the taxicab fit into the life of the busy man of affairs. Time is money, and as a time-saver the motor truck is also a money-saver.

It frequently happens that a contractor will run out of certain important material—it may be lumber and it may be cement—and the job may be several miles away from his source of supply. It would take a horse and wagon several hours to get what was needed and return, and in the meantime his workmen are idle.

With a motor truck the trip could be made in one-fourth of the time it would take a horse and wagon.

Another important use for the motor truck is in the transportation of tools and men from one job to another, with a minimum loss of time. When one job is lagging behind schedule it is possible to borrow men and tools from a job that is progressing more rapidly, and transfer them in short order.

Many contractors who own motor trucks are also finding it profitable to take work in the country or in surrounding towns—work that they formerly had to pass up because of the difficulty and expense of getting and keeping labor in the country and the difficulty in getting materials and tools to and from the job. With a motor truck the contractor can haul his men to work every morning to the out-of-the-way job and bring them back every night, and can handle more work with the same tools and equipment than he could if he depended on horses and wagons, because of the speed and flexibility of motor-truck service.

The contractor with a fleet of motor trucks is not entirely dependent upon the railroads for hauling his materials; he can save freight bills, and even railroad strikes will find him well prepared for the emergency.

As to the cost of motor haulage, the only way to arrive at the absolute net cost of a transportation sys-

tem is to take it apart, item by item, and put it together again.

If you are accustomed to horse-and-wagon delivery, it is pretty certain that you are unaccustomed to close figuring. The continued use of horse-and-wagon methods—the natural uncertainties in the condition and service of horses—all the attendant details of expense—make it hard to place a finger on your hauling costs.

Motor delivery accords with the "speed-up" spirit of modern business. Where the horse formerly jogged four or five miles an hour, the truck travels fifteen to twenty and arrives on the dot. Sweltering sun nor blustering blizzard, mud nor slush nor ice-glare prevail against it. The motor truck is always ready for rush orders. It really reduces man-hire, because a good delivery car and driver take the place of three or four teams and drivers; nor does a delivery truck pile up operating cost when not in use.

Compare a three-mile radius with one of fifteen miles, and remember that circular areas are to each other as the squares of their radii. This means that the "sphere" of the average horse and wagon with a three-mile-radius is to that of the truck as 9 is to 225—or as 1 is to 25. In other words, with a motor truck you have access to 25 times more territory.

There are times when you need your horses all day and half the night—or twenty-four hours a day. But you can't use them. You wouldn't if you could. You don't want to be cruel—you want to conserve the animal's strength—and you are not flirting with an argument with Humane Society officials.

With a motor truck, the length of its day is in your hands. Give it gasoline and lubricating oil in proper quantities and at proper intervals and its day is limited only by the tensile strength of steel. Horses and wagons—barns, feed bins, etc., require twice the stabling space of motor trucks. And remember horses must be stabled near at hand, where rents are high. The motor truck saves money by reducing the rent.

The best available figures on hauling are only relative. They vary under different conditions, but they are eloquently suggestive and full of interest.

A well known trade paper is authority for the statement that records of service covering periods from six months to a year, in New York, Chicago, St. Paul, Memphis and numerous other large cities, indicate that the average cost of hauling by motor is $11\frac{1}{4}$ cents per ton mile compared to $17\frac{3}{4}$ cents by horse. This represents a saving of 36 per cent.

From another angle, the cost of delivery of packages and merchandise from the stores, as estimated by the same publication, is respectively 8 and 15 cents for motor and horse, showing a saving of nearly 50 per cent for the former.

Another trade publication gives the actual cost per ton mile of hauling with horses at 14 cents to 18 cents for a double team in the city and 20 cents to 35 cents for a single horse. This paper gives the cost per ton mile with motor truck, all items of overhead expense included, as from about 7 cents for a five-ton truck to $11\frac{1}{3}$ cents for a one-ton truck.

Another authority states that it costs \$6.00 to \$6.50 a day to keep a wagon and team of horses at work. But the motor truck does the work of three such outfits—and at a saving of $33\frac{1}{3}$ per cent. Figured in cost per ton mile, the gasoline motor vehicle shows an efficiency of 175 to 200 per cent as compared with horses.

But even if the cost of motor trucks were the same as horses, there is absolutely no estimating the value to you in doing the thing right—the modern way. "The world do move"; people are becoming motorized,

and the contractor who would keep pace with the times must consider the motor truck.

Some Specific Examples of Truck Performance on Contracting Work

Some illuminating data have developed from the experience of contractor Louis Hoffman, of Grafton, Wis., with a $3\frac{1}{2}$ -ton Acme truck, manufactured by the Cadillac Auto Truck Co., Cadillac, Mich., equipped with the combination stake and dump body, on road construction work.

This truck is engaged in hauling crushed stone on state road work at Belgium, Wis., also in moving freight and coal. Mr. Hoffman informs us that this Acme does the work of seven teams. It makes 11 trips a day over a $4\frac{1}{2}$ -mile stretch, carrying 3 yards each trip, a total daily tonnage of 33 yards of crushed stone. As the teams on the same work are making but three trips, carrying but $1\frac{1}{2}$ yards each trip, it would require more than seven teams with seven drivers to equal the hauling capacity of the $3\frac{1}{2}$ -ton Acme.

Data on the operating cost of a $3\frac{1}{2}$ -ton dump truck in road-making, as compared to that of horse-drawn equipment, follow.

Operation Cost of $3\frac{1}{2}$ -Ton Dump Truck in Road-Making Work

The following analysis shows comparative yardage moving capacity and the equivalent cost of the motor and the animal-drawn handling system, the actual saving in money and the greater tonnage delivery capacity of the motor truck method.

The figures have been verified from the actual experience of road contractors in the states of Ohio, Indiana and West Virginia.

Six teams have been considered as the equivalent of one $3\frac{1}{2}$ -ton dump truck. The six teams, with wagons and harness, have been estimated to represent an investment of \$3,500, the cost of a first-class truck of the size mentioned. The operating cost will then figure up about as follows:

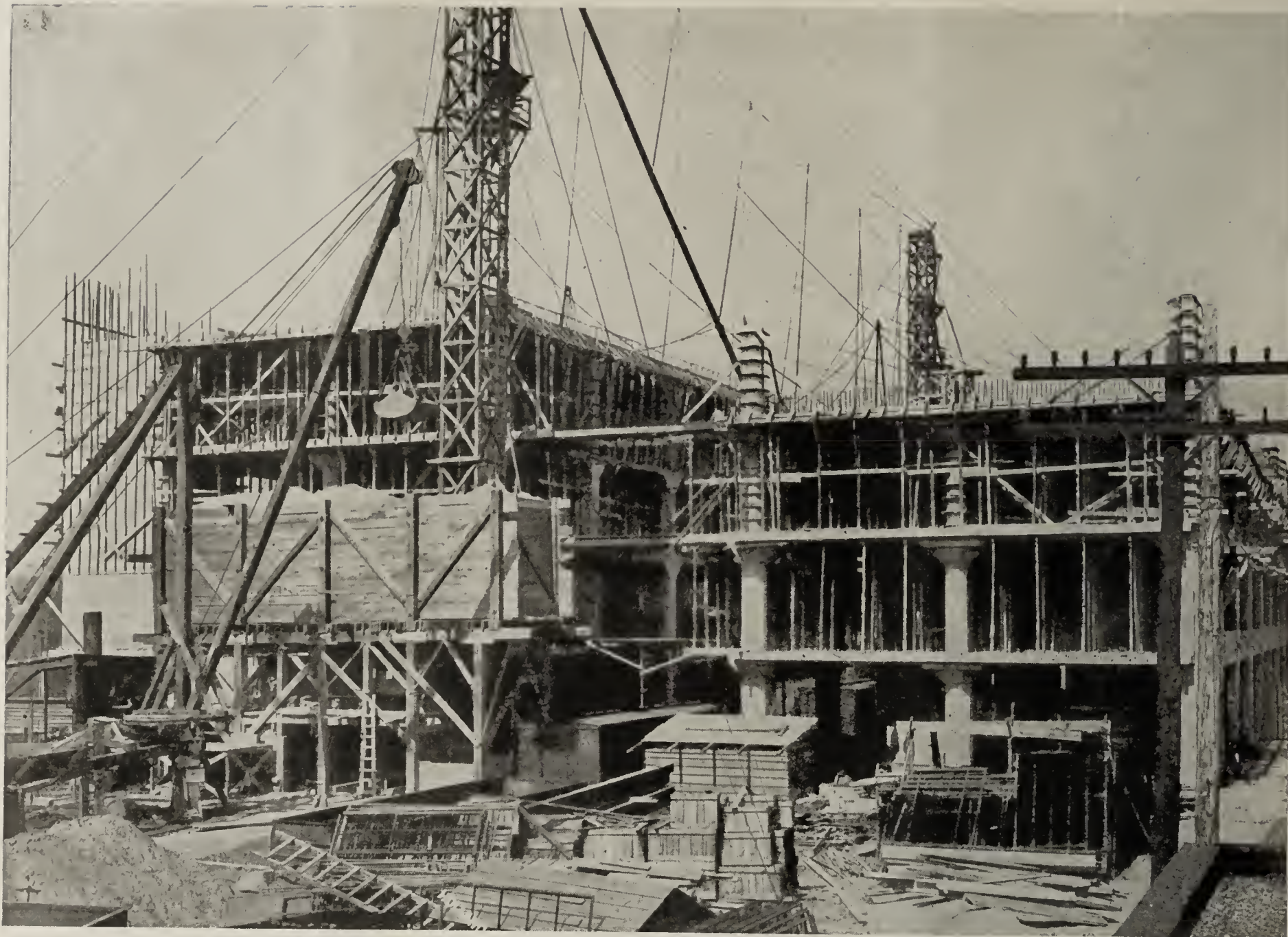
Six drivers	\$ 9.00
Feed	6.00
Shoeing	1.50
Interest on investment.....	.60
Natural depreciation	2.10
Repairs	1.20
	\$20.40

We have here a per diem cost of \$20.40. It is claimed that the teams will average five 2-mile trips each per day, hauling an average of 2 yards per trip. Dividing a total haulage of 60 yards into \$20.40 gives a cost of 34c per yard.

Now consider the operating cost of the motor dump truck. It is made up as follows:

Interest on investment.....	\$.60
Natural depreciation	2.10
Driver	3.00
Gasoline	1.80
Oil	.30
Repairs	1.20
Tire wear	2.40
	\$11.40

For this \$11.40 the truck will make two round trips per hour (two miles per trip, as above), hauling 3 yds. per load. Hence in 10 hours it will just equal the performance of the six horse trucks, but at a cost of only 19c per yard—just about half as much.



New Reinforced Concrete Structure Being Erected in Indianapolis by the Ford Motor Company.

Construction of Indianapolis Service Building for Ford Motor Company

The construction of the Indianapolis Service Building of the Ford Motor Company presents some interesting design and plant features. The design is rather unusual and a brief citation of the general features is therefore necessary to give a clear understanding of the construction.

The building is 317 feet long by 141 feet wide, four stories high, of concrete construction throughout, except for the front and rear walls, which are of brick. It is divided into two units by an enclosed shipping court 34 feet wide and 264 feet long extending from first floor to roof, where it is covered by a monitor skylight carried on a reinforced concrete roof trusses. Just below the roof trusses is a bridge crane runway on reinforced concrete girders carried on the top of the building column. At the various floors reinforced concrete balconies project out into the court to facilitate the handling of materials and assembled cars, to and from the floors. The service switch track enters at the south end at a level 4 feet below the first floor, a portion of which serves as a shipping platform.

The floor and roof slabs are flat slabs of the Akme two-way reinforced type supported by reinforced concrete columns with flaring capitals, the typical panels having spans of 26 feet by 23 feet 4 inches. The first story is used for show rooms, general offices and service garage, while the other stories are given over to

the various operations in connection with the assembly of automobiles. Two large freight elevators, a passenger elevator and three reinforced concrete stairways give access to the different floors.

The columns rest on circular pier footings belled out at the bottom to keep the bearing on the gravel stratum within the allowable. These piers, which average about 16 feet in depth, were built without sheeting the holes while excavating, the clay of a stiff character standing up without the aid of any bracing.

The present structure is only a part of the ultimate plan and the south end of each floor is so detailed as to permit of future extension without changing the spacing columns or the general scheme of construction. To accomplish this purpose the floors were extended 4 feet beyond the center line of the outer row of columns and a continuous Z-shaped shelf, consisting of steel angles, anchored to it, 6 inches back from the face to carry the future slab. Holes were punched in the angles at point near top of slab at 6 inch centers and short stub bars placed through them and bent up for one-half their length into the present end wall of brick. When the building is extended the spandrel walls will be removed and the bars bent down so as to tie the new slab to the old. The columns and foundations at the south end are designed for the future loading. The scheme of cantilevering the slab out beyond columns was

adopted since it gives a more nearly balanced condition of loading on the end footings for the present construction.

The receiving balconies projecting out 8 feet 6 inches beyond the center line of the courtway columns are of the same thickness as the main floor slab at their junction of 6 inches at the outer edge where they are faced with 10-inch channel iron curbs. The balconies are reinforced in the same general manner as the floor slabs.

The roof construction installed over the craneway is unique in that reinforced concrete king-post trusses and T-beam rafters were used to support the skylight frames. The monitor framing consists of eight trusses of 35 feet 6 inches clear span spaced 26 feet centers resting on the reinforced concrete piers of the monitor sidewalls. At the top the trusses are connected by and support a continuous T-shape ridge girder, which in turn supports the pair of T-beam rafters dividing the space between trusses into three bays.

Construction Plant

Mixing Plant.—A very complete concrete mixing and distributing plant was erected by the contractors. This plant was located at the south end of the building alongside the switch track.

Storage bins with inclined bottoms for gravel and sand were erected on a heavy timber framework about 18 feet high, below which the mixer was placed. A platform was built about 10 feet above ground with an inclined charging hopper to mixer drum. One end of this platform served as a storage for cement. The aggregates were received in gondola cars and hoisted up into the storage bins by means of clam-shell bucket operated by a stiff-leg derrick, and were then conveyed by chutes from the bins to measuring hoppers discharging into the charging hopper of mixer.

Distributing System.—On account of the length of the building two distributing towers were necessary to obtain a satisfactory distribution of concrete with spouts. These hoisting and distributing towers were constructed of heavy timbers framed and guyed at the top and intermediate points by wire cables.

The main tower was located at the mixer the same discharging directly into the hoisting bucket. On this tower two receiving hoppers were mounted, one near the top, from which concrete was relayed by an inclined spout to the receiving hopper of the secondary tower erected on the craneway space at the north end of the building. Here the concrete was again elevated to the distributing hopper near the top of the tower from whence it was spouted to any point at the north end of the building. This tower supplied the major portion of the building and the south end was served by an auxiliary spouting system swung from the main tower.

The spout from the main tower to the receiving hopper of the auxiliary tower was of the three-quarter round type supported at six intermediate points by manila ropes run through pulley-blocks at top and bottom, the upper ones being fastened to small pulleys running on a wire cable stretched between the tops of towers. The distributing spouts were made up of short sections of spout with swivel head and hopper, into which the section above discharged. The lower end of the first section next to the tower was supported by a rope from a swinging jib boom mounted on the tower. By means of this and the swivel head connections at ends of the various sections the spouts could be swung to any desired position.

The foundation piers were concreted while the distributing system for the superstructure (just described) was being built, the concrete being hauled in

carts from a temporary mixer plant since the main plant was not completed.

Floor and Column Forms.—The formwork for floors consisted of 2-inch ship-lap sheeting laid on 2 by 10 inch yellow pine joists spaced about 3 feet centers. The joists were supported directly on 4 by 4 inch posts about 3 feet centers, tied together by two lines of longitudinal and transverse bracing and some diagonal bracing. The forms for plates on column heads were supported on their outer periphery by inclined struts resting on the upper collars around the column forms.

The column forms were of 2-inch yellow pine lumber held in line with heavy wooden ties or collars about 3 feet centers.

Bending and Placing Reinforcement.—The column spirals were shipped to the job fabricated, having been collapsed for shipment. After the column forms were erected, the spirals were opened up, the spacers properly spaced, a few of the vertical bars placed inside of the spirals and wired thereto. These units were then placed and centered in the forms and the remainder of the column bars put in. Where the column sizes decreased at floor lines or where the column bars were closely spaced (less than 5-inch centers), they were bent at the top where they lapped with those above, so as to come inside the ring of steel in the column above.

The floor steel was shipped to the job from the mill cut to the various lengths as shown on the detail plans and then bent to the proper shape as indicated by the bending details furnished by the engineers.

After bending, the bars were placed on the forms, the portions of bars in bottom of slab being supported by steel raising chairs 1 inch high, while the portions of bars in upper part of slab over column heads and those transverse to main bands of steel, at centers between columns, were held in place by three lines of 7/16-inch plain square raising bars supported on precast concrete blocks 4 by 4 inches in section.

The reinforcing bars were wired to these raising bars in order to maintain their proper position and in addition 7/16-inch square spacing bars were wired to the main belts of bars in lower portion of slab.

Concreting Columns and Floors.—The columns were concreted up to where the flaring head started and some little time allowed to pass before placing the column head concrete so as to allow shrinkage of concrete in the columns. The floors were poured in four or five sections, the bulkheads between sections being placed at center lines of panels between columns or at points of minimum shear.

Monitor Construction.—The forms for complete sections of monitor including sidewalls, trusses, rafters and ridge girders were erected, the reinforcement placed and the concrete placed by means of carts on plank runways from the hoisting towers at either end of the building. The forms for trusses and rafters were supported on wood lattice trusses spanning between the finished crane girders and braced by diagonal struts to the floor below.

The floors to support elevator machinery in pent-houses consist of a 6-inch reinforced concrete slab carried on the brick enclosing walls and on structural steel I-beams encased in concrete, placed directly under the machines.

This type of construction was considered more practical and economical than an all reinforced floor, since the forms to support the slab concrete could be hung from the I-beams, thus eliminating the expensive formwork required for the latter due to the absence of supports directly below the slab in the elevator hatchway. Furthermore, due to the heavy concentrations and location of openings in floor reinforced concrete beams would have been of undesirable dimensions.

Building the Stucco-Coated House

Some Reasons Why This Form of Construction Should Appeal to the Present-Day Home Builder.

By Warfield Webb

In building the home we have many important matters to keep in mind, as there is a vast difference between a "home" and a "house." The latter is a living abode in many cases, but the former is to be the ideal, and the one place that should be so erected. The important consideration then is to make the home attractive from the outside. More people see the exterior of the home than the interior, and a good appearance should be planned out well in advance.

There should be a study made of the location—the setting—the size, the style and the material for the exterior. The latter becomes vital, because upon its selection must depend the final success of the undertaking. The exterior should comprise art, durability, good taste, and be capable of making the ideal that we have set up for ourselves. Now there are many styles of exterior material. These comprise a variety of color effects, and when properly put in place bring into being the most exacting requirements of the owner.

If we build we should keep before us the nature of the building, its location, and try to make the material harmonize with the surroundings. Do we fully value the effect that this brings about and the lack of which does so much to depreciate the home from an artistic point? There should be in mind the idea of erecting a home for its beauty, and this becomes, not only to ourselves a source of gratification, but enhances the value of the structure, and magnifies its true value.

There is, however, a vast difference between the home with true art in the exterior, and one that partakes of the cumbersome type, the sought-after-effects having been stifled in the effort to create something different. The true beauty lies in simplicity, and this is easily attained where the effort is made in earnest. Simplicity in design is the most striking evidence of real merit. The insignia of beauty lies in its greater conception as applied to the home.

Today we see many homes erected with a stucco exterior. This is due to several things. In the first place the style of the house is such as to make the exterior inharmonious. The lines and angles are out of proportion and the setting lacking in important respects. The exterior itself is devoid of proper color effect, and the material, sometimes of poor quality and improperly applied, gives the structure a hideous appearance.

To make the stucco exterior home of real attractiveness, and to make it likewise

lasting, we cannot afford to use inferior material. The logic of this is so plain as to need no comment. Then, with good material in the hands of inferior or careless workmen, there will be a like unsatisfactory job, and the house will be to the owner what it is to the beholder—a miserable makeshift. It might be added that with the use of the best stucco the effects possible are wonderful, and with the use of the contrary kind there is nothing that will so mar the value and its outward appearance.

Some contractors, and they are not alone the guilty parties in such cases, resort to inferior material, with the addition of inferior workmanship, and in this way make the home anything but attractive and a just cause for complaint. To make stucco durable, attractive and combine with these attributes the effects that are sought by the home builder, the best material only should be applied to the walls. In no case should lime become a part of the stucco, as lime kills the life of the material, as well as its appearance.

It is an erroneous idea that some home builders have that stucco can only be made in the natural cement color, or confined to gray, of several shades, or white. The inferior grades, it must be admitted, are confined to a limited number of colors, and even then to such shades as will not long retain their original hue. Instances of this are common, and further there are to be seen vast cracks, even loose sections and sometimes large sections falling off.

These defects are laid to the foundation, or to the lath, by the man who has applied the stucco many times, and he seeks to hide his own inferior material or lack of conscientious labor. Good stucco, that which contains no lime at all, only a combination of Portland cement, pure sand or silica and crushed stone, marble, quartz, granite, or whatever aggregate may be used as the finish, when placed upon a foundation of either wood or metal lath or other durable surface will insure the very best possible results to the home builder. It

will do more—it will be possible with a material of this kind to make the color effects not only of many hues, but to harmonize with any desired effect.

The Color Scheme

The colors are of the most delicate hues and the shades will last as long as the house itself. But there must be care exercised in the building of the home to bring about this result. The entire structure must be built with honesty and good materials should be used in all important sec-



A Cement Stucco House at Chestnut Hill, Mass.

Chapman & Frazer, Architects.

tions. If the foundation is weak in any part, we must expect the best quality of stucco to show cracks when the house settles. Even brick and stone will crack under such strains. The fault in this case is due to inferior workmanship.

The lath should preferably be metal, as it has proven its greater service for such work. Where the best Portland cement stucco is used, however, wood lath, when properly applied, will give entire satisfaction to the owner. One thing should be kept well in mind, and this is the security of the roof. If there are any weaknesses in this way, there will be some serious danger of the best stucco being damaged. The base, water tables, sills, door and window frames should be set with care and the other exterior sections of the house in no essential part slighted. The results of this carelessness will act as a loophole and will permit the stucco to show greater or less damage.

When properly applied stucco should be put on in



CEMENT STUCCO RESIDENCE OF JOHN J. NOLAN, WEST MEDFORD, MASS.

Architect, John J. Smith, Boston, Mass.

Stucco houses are today one of the most popular styles of dwellings, and there are an increasing number of them being built every year. Considered from the viewpoint of the owner, they have many economical advantages which is no doubt the reason for the constantly increasing demand for this type of house by the prospective house-owner. They have passed the experimental stage and have become one of the standards.

three distinct coats. The first, or scratch coat, with as much care as the second and final or "dash coat." The second coat serves as a greater foundation and as a surface for the outer finish. This third coat can be either of "rough cast" or "float," according to the nature of the application, one being less uneven in texture than the other. There should be ample time allowed between the application of the several surfaces to permit them to dry out, and become hardened before applying the successive coat.

To make the color effects possible one has to purchase only the best Portland cement stucco, the color being already mixed in, and only needing the addition of water to make it workable. Sometimes marble, granite, or quartz chips or gravel are used to make a more attractive exterior possible. Some of these, when mixed and applied with intelligence, permit of an acid washing, that brings out most wonderful effects and distinguishes the house for its signal beauty.

Good stucco can be applied to wood, metal, brick or tile surface. In the remodeling of homes it has been found an ideal material. It is so easily applied and the cost so low, comparatively, that it has become one of the very popular materials for home building. It is durable, lasting for years intact, and is accepted by the insurance fire underwriters as a fire resisting material even when applied to frame houses.

Building for Durability

It might be considered, at least by some, to be an inferior and cheap house material. Today there are a large number of residences coated with the best quality of stucco. The inferior kind is only found on the cheap house. The man who builds the more costly home is insistent upon having only the best, and this costs so little more than the less desirable kind as to be only a trifling reason why it should not be adopted by the home builder. He is not building for a day or a month, month, but for years, and he should have not only an attractive exterior, but one that will serve him for years and always be to him a source of comfort.

Reinforcing Bar Bending Machine

The Waterloo Construction Company, of Waterloo, Iowa, has recently placed upon the market the Waterloo reinforcing bar bending machine. It is made in two sizes, and guaranteed to bend bars as follows:

No. 2 bends cold reinforcing bars, including $1\frac{1}{8}$ inch round or square.

No. 3 bends cold reinforcing bars, including $1\frac{1}{4}$ inch round or square.

It is a durable, substantial constructed machine, so arranged to bend reinforcing bars to various angles for all purposes in concrete work. The bending posts are constructed of turned steel, the post revolving through the slot in the plate being equipped with loose steel roller to avoid creeping of bar in bending.

The machines are furnished with a detachable handle seven feet long for convenience in handling. Bars can be bent to a more uniform angle than by any other method and get the maximum strength as designed by the engineer.

Write for circular and prices.

New Book—Practical Road Building

By CHARLES E. FOOTE

Two hundred and ninety-five pages, $4\frac{3}{4} \times 7\frac{1}{4}$ in., illustrated, \$1.25, David McKay, publisher. Sent on receipt of price by Cement and Engineering News, Transportation Bldg., Chicago. Following a brief history of ancient road building and modern development, 18 chapters are devoted to location, grades, excavation and fill, slopes, crown, ditches and culverts, various types and conditions of foundations, road construction and maintenance, earth, gravel, sand-clay, top soil, Macadam, brick, concrete, bituminous, and asphalt, and special surface roads, with descriptions, specifications, estimates of costs, diagrams, and other practical information concerning their construction and maintenance, and methods, operations, and equipment required. The book is a resume of current practice, and summarizes highway construction in this country.

Austin Mixers Give Satisfaction

The Municipal Engineering & Contracting Company of Chicago, which has selling agents and warehouse facilities in the principal cities of the United States, have recently published some attractive and valuable literature descriptive of the company's splendid line of concrete mixers. Every engineer and contractor has doubtless heard of the 150-mile concrete road system of Wayne county, Michigan. These roads are notable for the excellence of their construction at minimum cost. The fact that Austin mixers were used exclusively on this work speaks well for their superior qualities. Nine Austin plants were employed—a plant consisting of engine and boiler, mounted on heavy steel trucks, with or without distribution boom. One of these pavers is shown in the catalogue at work on San Pablo avenue, Oakland, California.

Following is a sample testimonial from one of Fort Wayne's big contractors:

"Municipal Engineering & Contracting Co.,

"Railway Exchange Bldg., Chicago, Ill.

"Dear Sirs:—We herewith enclose our check and voucher in payment of the attached invoice covering No. 0 Batch Mixer. Kindly receipt same and return.

"We have found this mixer satisfactory in every respect and it completely fulfills our expectations.

"Yours very truly, "GRACE CONSTRUCTION & SUPPLY CO.,
"Martin J. Grace, Gen. Manager."

The Manufacture of Concrete Burial Vaults

You don't have to wait until the frost is out of the ground to start manufacturing concrete burial vaults, writes the Automatic Sealing Vault Company, 216 E. River street, Peru, Ind. The best time to start the concrete burial vault business is right now, when outside work is generally tied up on account of weather conditions and you have a chance to get well under way and get a stock of vaults made up for spring business. There is no mystery about the manufacture of burial vaults—it requires the same care exercised in making building blocks. Our machine manufactures vaults of any required size. You simply buy the machine and start turning out a product. You don't have to pay us for anything except the equipment actually needed.

Let us send you a book about the burial vault business. It shows exactly what our machine will do, what people think of the vaults made on it, how to market burial vaults and what manufacturers of Automatic Sealing Vaults are doing all over the country. This book was written partly by our selves and partly by satisfied users of our machines. A copy will be sent you free, on request.

Olympic Cement Plant

When the Olympic Portland Cement Company's plant at Bellingham, Wash., closes for the winter next November, as seems probable that it will, it will have on hand about 250,000 barrels of cement, of which 100,000 barrels will be ready for shipment. The remaining 150,000 barrels will be given the final finish during the winter. At \$2.75 per barrel, the present price, the entire product, if finished, would be worth \$687,000. The plant is now running full blast, which means that it is producing 2,000 barrels a day.—[Bellingham Herald.]

Efficiency Engineer for Alpha Cement Company

Harry A. Reichenbach, efficiency engineer for the Bethlehem Steel Company, has resigned his position to accept a similar one with the Alpha Portland Cement Company, of Easton, Pa. This company has plants at Alpha, N. J., Martins Creek, Pa., Cementon, N. Y., and Mannheim, W. Va., and Mr. Reichenbach will visit the Cementon plants for several weeks, afterward making his headquarters at Easton. Mr. Reichenbach is a graduate of Allentown High School, Bethlehem Prep. and Lehigh University in Mining, in 1909.

MACHINERY FOR SALE

Our entire machinery equipment consisting of two steam shovels (one Marion 3-yd. model 61, practically new, one Bucyrus 2½-yd.). Two Locomotives (62 and 50 tons). Ten side dump cars standard gauge. Four Fairbanks-Morse oil and gas engines (32, 32, 8 and 5 H. P.). Two Fairbanks-Morse Duplex Pumps (10½x12 and 5x6). Other pumps and engines, Electric Light Plant, Gravel Washing Plant, Piping and many other items. Everything in good condition. Plant now running, but will close down November 1st account car shortage. Morgan Sand & Gravel Co., Inc., c/o Ouachita Natl. Bank, Monroe, La.



Direct Mail Advertiser's Reference Book

Just from the press. A practical business encyclopedia for the direct mail advertiser. Covers entire field in its relation to your business.

The following partial table of contents shows some of the reasons why you should send for a complimentary copy of this valuable reference book:

- "The economical efficiency of Direct Mail Advertising."
- "How I found my liveliest prospects in five minutes."
- "How to multiply your ability, experience and energy."
- "Art, lithographing, and color printing club plan."
- "How Purchasing Departments use Mailing Lists."
- "The comparative value of 1c and 2c postage."
- "Map graphic charts: population, agriculture, live stock, etc."
- "Testing new plans and policies."
- "Analytical advertising and sales promotion."
- "Picture gallery of reasons why."
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- "Helping your salesmen."

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"LONGLIFE" makes its own class and it's a mighty exclusive one. We continue to offer a free membership in this class to any other Conveyor Belt—rubber, canvas, Balata, or what not, with the proviso that it does as good, or better in service than "LONGLIFE."

The offer has been open a long time—without any takers.

They Know They Can't Beat
"LONGLIFE"

THE B.F. GOODRICH COMPANY

Makers of the Celebrated Goodrich Automobile Tires—
"Best in the Long Run"

AKRON, OHIO
Representation Everywhere



Profits in Cement Brick Making

They Are Superior to Clay Brick and Can Be Sold at Lower Prices

There are many reasons why cement brick are fast coming into their own as factors in the building industry. Not only can they be profitably manufactured and sold at a price even lower than the common clay brick, but they are superior in quality. They have greater com-

pression strength, are more waterproof, and through the use of richer facing materials offer the architect and builder a greater variety of artistic surface treatments.

As backing or filler brick they have double the compression strength of the common clay brick, and realizing that concrete brick are a better article and better value, builders and architects are specifying concrete brick for this purpose wherever they can be obtained. They have seen the common clay variety crack, spall and disintegrate, whereas, concrete brick improve and grow stronger with age.

Sand and cement are easily obtained at very low prices in nearly every locality, so that the manufacturer of concrete brick has a further advantage in quoting delivered prices, especially where clay brick have to be shipped in at considerable expense and loss on account of breakage.

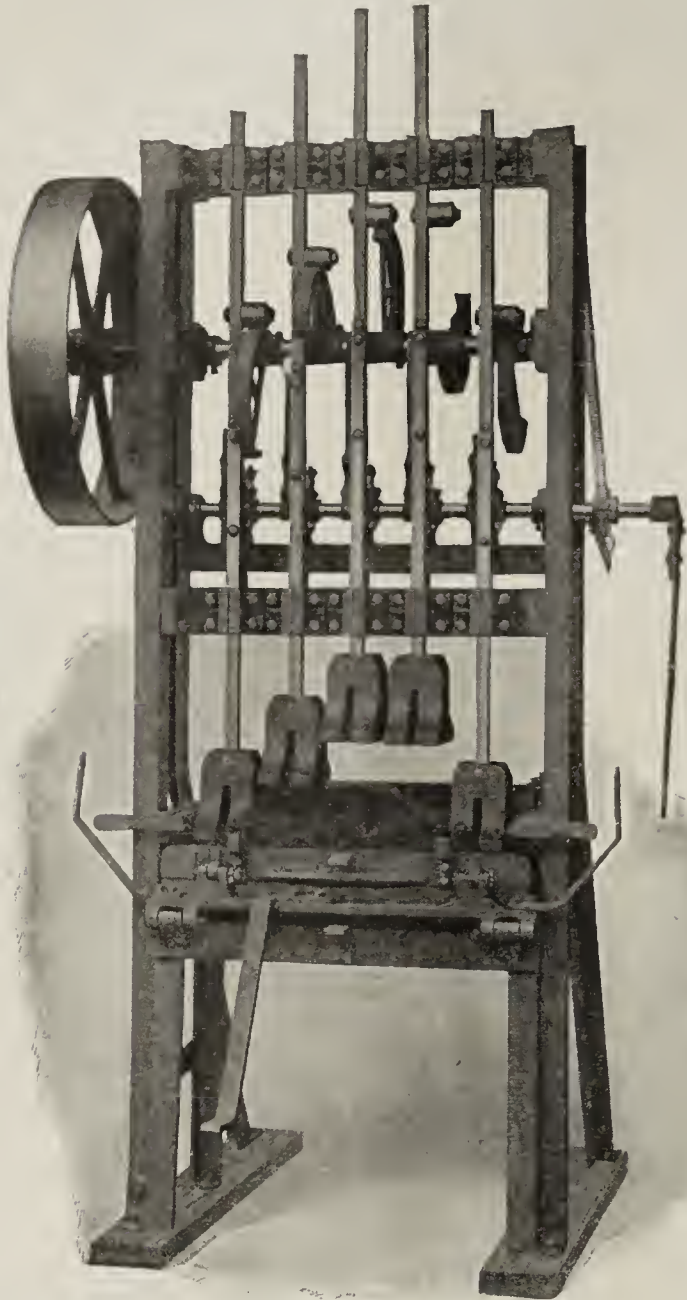
The Ideal Concrete Machinery Company, 1353 Monmouth avenue, Cincinnati, Ohio, have succeeded as a result of expert investigation and tests, perfected a machine that has been found to meet the requirements of perfect cement brick making. The machine has been designated as Model "F," and is here shown in illustrations, the first supplied with a gang tamper for hand operating, tamping 10 bricks at a time, and the other a complete power outfit for tamping brick automatically.

Bricks are made on the Model "F" machine by the tamped process, not pressed. This is considered the correct way of making products of this kind, as it eliminates all voids and drives out the air pockets, making a solid and stronger brick.

Experienced help is not required. The machine is so simple and easy to operate that anyone can make good brick with but very little practice. There is only one lever to operate. Every wearing part of the machine has been case-hardened, so that it can be used steadily, day after day, with no delays for adjustments and repairs.

The Model "F" machine is a one-man outfit, simple in design, durable in construction, swift and economical in operation. It is a complete brick plant in itself, needing no accessories or other equipment, unless possibly a mixer. It makes 10 faced or common brick at a time, all exact in size and proportion and having sharp corners.

If you are in any way interested, write the company and they will place their service and engineering depart-



Model "F" Cement Brick Machine with Power Tamper.
(Discharge Position.)



Model "F" Cement Brick Machine with Gang Tamper.
(Closed Position.)

ments at your service, whereby you can secure such information as will safely guide you in entering the cement brick making industry.

Peninsular Cement Company

The Peninsular Portland Cement Company, Cement City, Mich., has outstanding \$593,750 of common stock and \$710,420 of 7 per cent preferred. Full dividends were paid on the preferred for some years preceeding 1909. From 1909 to 1913, inclusive, only 14 per cent was paid, leaving 21 per cent accumulated. In 1914, 1915, and 1916 the full 7 per cent was paid. Gross profit in 1916 was \$213,756. Out of this the preferred dividend of \$49,729 was paid, and most of the balance set aside for depreciation and new construction. Indications are that not enough has been allowed for depreciation in the past.

Cement and Engineering News

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December 1917

No. 12

The Use of Concrete Work on the Farm

Contractors Can Make Good Profits in Constructing All Types of Concrete Buildings



An Excellent Example of Barn and Silos Built of Concrete Blocks.

Progressive contractors and builders doing business in farming communities have long since been convinced that concrete on the farm has come to stay. The man who years ago confined his activities to foundations and floors is now busily engaged in building complete structures of concrete and specifies this material wherever he can. The farmer is being educated to appreciate the fact that the first cost is not always the most important and that it is essential to have structures that are permanent and require practically nothing for main-

tenance. There is not a single farm building that cannot be constructed of concrete and steady progress is noted in the use of concrete for farm residences. Numerous opportunities for profitable business await the contractor who will familiarize himself with the many features of concrete as they are suited to the needs of the farmer.

A close study of the requirements for all classes of buildings will soon stamp the contractor as a specialist in this line and his experience will qualify him to make valuable suggestions to his clients.

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Advertising copy or changes in ads. must be in this office by the 25th of each month, as hereafter our magazine will appear on the 5th of the following month

Advertising Rates Sent on Application

JOHN F. WALDRON

Advertising Manager

CHICAGO, DECEMBER, 1917

Sand and Gravel Producers' Convention

The annual convention of the National Association of Sand and Gravel Producers will be held at the Great Northern Hotel in Chicago, February 7 and 8, 1918. The subjects for discussion include:

- Cost Accounting.
- Transportation Problems.
- Trade Practices or Trade Relations.
- Plant Products—(grading and standardization).
- Insurance—(fire, liability, and compensation).
- Extension—(promoting the use of sand and gravel).
- Plant Economics—(operating problems, co-operative purchasing).
- Open Price Competition.

These are live problems for the sand and gravel man. The discussion will be opened by the presentation of specially prepared papers by those who have given the subjects special investigation and consideration. Remember the date and plan to attend. Send in your membership application now.

The supreme importance of a well-attended convention which will take action to make the national association thoroughly representative of the great industry for which it speaks has just been strikingly brought home to us by the issuance of Priority Order No. 2, which like a thunderbolt from the clear sky caught everybody unprepared, writes Burton H. Atwood of the Atwood-Davis Sand Company of Chicago in "Rock Products."

We have now learned that it has been hanging over our heads since the end of August. The War Board originally intended to put it into effect on September 1st, but, as we are informed, out of consideration for the interests involved, action was deferred with the hope that conditions would improve so as to make it unnecessary. Undoubtedly the coal operators are well represented at Washington, and neglect no opportunity of impressing upon the authorities their side of the car question. There has been a great hue and cry about the shortage of coal in the Northwest, and perhaps with reason, but we find it reported in the *Traffic World* of November 3rd that Priority Order No. 1 has

been revoked because the Northwest has received 3,000,000 tons of coal this year in excess of the supply in other years. These facts would seem to indicate that the sand and gravel shippers must be represented at Washington.

Recently the writer sat at a luncheon with less than a dozen gentlemen, who represented nearly \$1,000,000 of capital invested in the production of sand and gravel with a city of less than half a million population as central market. There are in the United States about 1,400 or 1,500 sand and gravel producers. Who can say what is the total investment in the production of this commodity; what is the total tonnage shipped by rail, and what amount of freight earnings are collected by the railroads on this commodity?

The campaign which has been started by the National Association of Sand and Gravel Producers purposed to accomplish two very definite objects.

1. To ascertain the amount of capital invested in the sand and gravel business, the number of tons shipped by railroad, and the amount of freight revenue collected by the railroads on this traffic.

2. To inform all producers of sand and gravel of the magnitude and extent of the industry of which they are a part.

It has been said that the beginning of wisdom is knowledge. When the sand and gravel producers become fully informed as to the importance and extent of the industry, they can and will begin to take the place in the affairs of the country where the industry rightfully belongs. In these days when so many governmental activities are conducted by commissions, it becomes important for large industries to be nationally organized, and to have available, for presentation when occasion arises, facts and figures which will secure for the industry the proper consideration. Who can say but what Priority Order No. 2 might have been still further postponed or at least a warning issued if the National Association of Sand and Gravel Producers had been represented at Washington.

Waterproofing Ordinary Concrete

The failure to secure waterproof concrete walls for the Sunshine Mills, El Reno, Okla., even after the application of two coats of hot asphalt inspired special effort to secure impermeability in the walls of the cellars of the 97x34-ft. six-story Liberty Bell mill, San Antonio, Tex. The cellar floors are 4 ft. below the surface of the ground and 1 ft. below the top of the waterbearing gravel. Waterproofing was therefore necessary and the application of an inside coating of asphalt burlap protected by a brick wall was under consideration when the use of hydrated lime with the concrete was proposed. It was conceded that in any event it would add to the plasticity of the concrete and would aid in filling minute holes, thus at least increasing the density and improving the finish at a very small cost for materials and at no cost for application.

For these considerations, James Smith, superintendent of construction, used hydrated lime in the proportion of 30 lbs. per yard for the 1,400 yds. of concrete required in the building, and says that when the forms were set the concrete was the smoothest and densest that he has ever seen, totally free from cavities, and impervious to water even when the lower part of the building was submerged by exterior surface water.

Mr. Smith attributed these results to the great density and plasticity imparted by the lime to the concrete and announced his intention to use hydrated lime in all future concrete work, even though waterproofing is not an object, because better concrete and easier handling are obtained.



Examples of Rough Surface Finish of New Park Buildings of South Park Commission

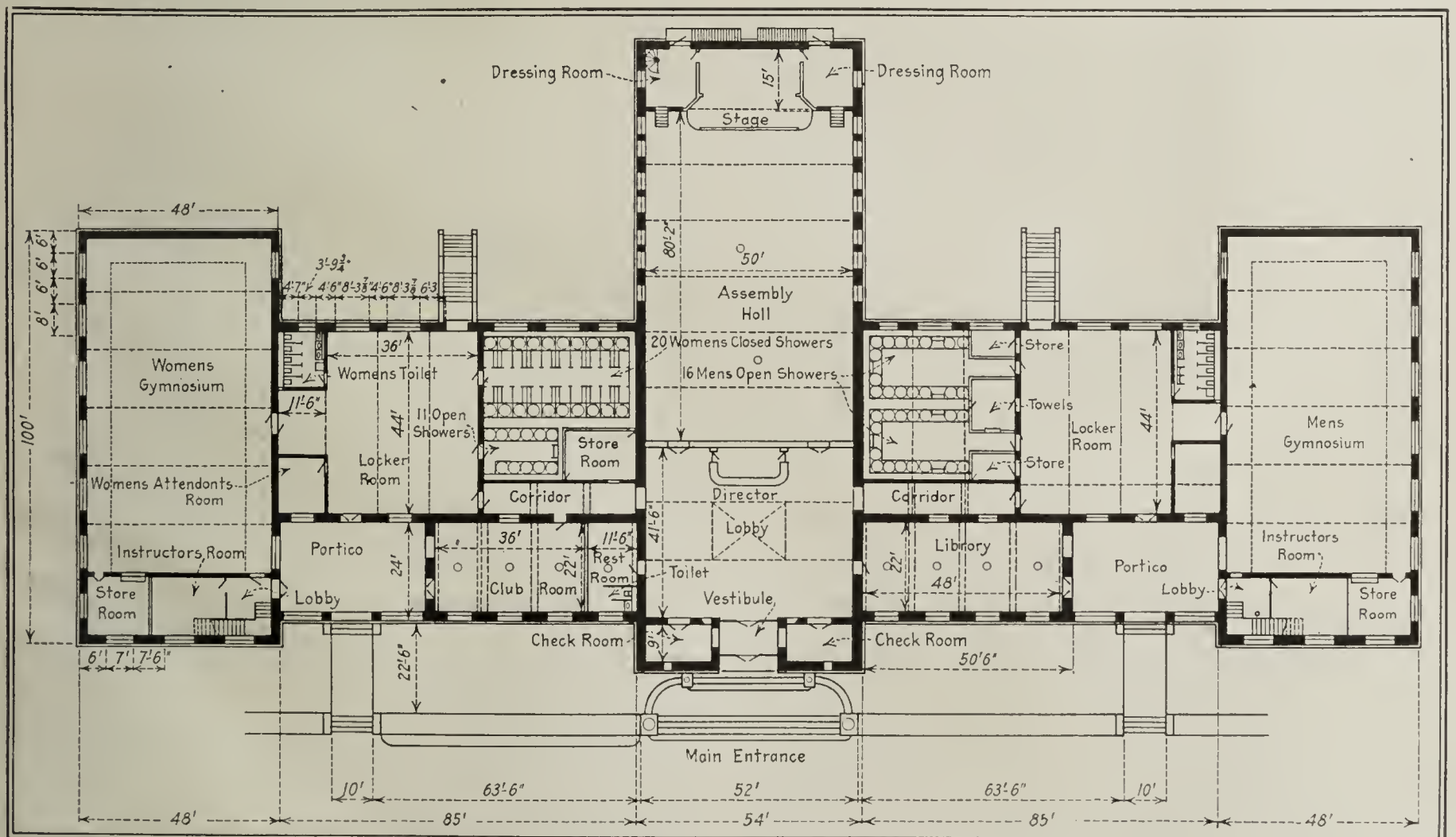
Design and Construction Features of New Buildings of South Park Commissioners of Chicago

The remarkably pleasing appearance at low cost which the South Park Commissioners of Chicago have attained during the last few years in buildings erected in the large number of parks under their jurisdiction is brought to highest development in a new group of structures under construction in McKinley Park. This park is located in the southwestern part of the city and has an area of 54 acres. The new buildings form the recreation center and consist of a large T-shaped structure and a power plant. The general dimensions of the large building are: Length, 320 ft.; central axis, 152 ft.; axis of the women's and men's gymnasiums, located at the ends of the structure, 100 ft.

The feature of greatest interest in these buildings is a monolithic concrete construction in which a rough uniform surface wall texture is obtained without tool-

ing or any kind of acid treatment. In the central and two end facades of the front of the new group of buildings the rough surface texture has been carried into more ornamental design by the extensive use of plaster cast forms than has been heretofore attempted in this style of surface. A great improvement in the design of these buildings as compared with others built by the South Park Commissioners is that they are so grouped that every department connects directly with the director's office, situated in a large lobby in the center of the structure.

The women's end of the building contains a gymnasium with lobby, instructor's room and store room; locker room with attendant's room and toilet; separate shower rooms for women and girls, the women's showers being enclosed in separate booths; club room



First Floor Plan of Group of Park Buildings, McKinley Park, Chicago, Ill.

and rest room. The gymnasium, locker room and club room are entered from a wide portico. The men's end of the building is similar in design to the women's end except that it contains a library room in place of the club and rest rooms. The center of the building is occupied by the lobby, check rooms and a large assembly hall equipped with stage and dressing rooms.

The usual style of wood forms were used for the walls, the forms being set up both horizontally and vertically as conditions required. For many of the panels and pilasters the forms were set vertically. The wall is made up of a central core of 4-in. hollow tile faced on either side with concrete, the tile being anchored into the concrete. The tile were laid in 12-in. courses followed by 12-in. courses of the concrete on either side. This permitted the concrete to be so laid that the line of break between two courses would be opposite the center of a course of tile.

The specifications for the aggregates in all exposed walls called for 2 parts of cement to 3 parts of torpedo sand and 9 parts of crushed limestone, the limestone to be screened to sizes that all would flow over a $\frac{1}{8}$ -in. mesh and pass a $\frac{3}{8}$ -in. mesh. A thorough machine mix



Construction View of New South Park Buildings

using a very small quantity of water is one of the most important features in producing this uniform rough surface texture concrete. The rule was to use only sufficient water so that the mixed concrete would adhere when firmly pressed in the hand. When placing the concrete it was tamped very hard in the center of the wall adjoining the tile core and very little near the surface.

All plans for these buildings were made by the engineering department of the South Park Commissioners under the direction of Mr. Linn White, Chief Engineer. Representatives of the South Park Commissioners say that the design and arrangement of these buildings are superior to any they have hitherto produced for park recreation purposes.

Cement Testers and Inspectors Wanted

The purchase of enormous quantities of cement by the Government in the present emergency has created an urgent need for experienced cement testers and inspectors in the testing laboratories of the Bureau of Standards. The Civil Service Commission has therefore announced a registration of eligibles for appointment to these positions at salaries of \$900 to \$1000. Qualified applicants should communicate at once with the Civil Service Commission, Washington, D. C., for detailed information regarding these appointments.

Good Road Drainage

Many of our roads must of necessity be built across low spots or, in an endeavor to avoid a too close proximity to streams by following the edge of the bordering hills, must cross wet spots due to seepage from higher ground. While the experienced engineer will locate the road so that these places are avoided as much as possible, it often happens that to shorten the route, prevent a sharp curve, or a heavy steep grade, he is forced to accept the challenge of draining these soft wet spots.

Ordinarily the construction of proper drainage ditches in wet, soggy ground is a very difficult matter. Horses, tractors, and machinery can seldom be used on account of getting mired in the mud, and hand labor is entirely too scarce and expensive to be used for such purposes.

One very successful road contractor uses large amounts of dynamite in general road work, and finds it of great assistance in ditching these wet spots. He uses the electrical method of firing, making the holes about 6 inches shallower than the grade line desired, and placing them about 30 inches apart along the center line of the proposed ditch. The charges of dynamite are primed with an electric blasting cap, placed in the holes, and well tamped. The electric cap wires are connected up in series and fired by a blasting machine. In this manner the entire line of charges explodes at the same instant, lifting the dirt high in the air and scattering it over the surrounding land, thus doing away with high banks of earth along the ditch.

He has become so successful at this kind of work that by proper loading there is no hand work to be done after the blast, as the ditch is left clean and clear of all debris, ready for immediate use.

A ditch averaging 4 feet deep and 8 feet wide on top can be made in this manner without the aid of a shovel of any kind. From 1 to $1\frac{1}{2}$ pounds of 40 per cent Low Freezing dynamite per hole is sufficient loading for this size of ditch in heavy soil.

The contractor claims that this method is most satisfactory from his standpoint, on account of economy, because of its quickness, and because of the saving in hand labor, which at this time of serious labor shortage is an all important item.

Concrete Burial Vault

The Automatic Sealing Vault Co., 216 East River street, Peru, Ind., has just issued a new catalogue, printed on good paper, and has some excellent illustrations showing not only the vault as manufactured but giving a clear idea as to how they are made. Send for a copy.

Concrete Protection

The Temescal Water Co., Corona, Cal., has recently protected 10,000 ft. of 24-in. riveted steel pipe that was seriously corroded by enclosing it while in service with a 3-in. jacket of concrete reinforced by spirally wound wire mesh in lengths of 75 to 100 ft. spaced away from the steel by cement filler blocks $1\frac{1}{2}$ in. thick. The reinforcement is enclosed by 8-ft. lengths of forms made with wooden staves lined with No. 26 sheet iron. The concrete invert is first laid under the pipe occupying about one-seventh of its circumference and the forms are set engaging it and clamped in position by triangular yokes securely bolted in place. The $1 : 2\frac{1}{2} : 1$ concrete is mixed wet and the forms are removed on the second day. Twelve men cover 100 ft. of pipe in a single 9-hr. shift at a cost of \$170 including backfill and excavation.

Building the Stucco-Coated House

The writer has noted with a great deal of interest Mr. Warfield Webb's article entitled "Building the Stucco-Coated House," pages 298 and 299 of your November issue. Mr. Webb has very flatly condemned the use of lime in any form for use in good stucco, and has apparently done so without reason, except his statement that the use of lime kills the life of the material, as well as its appearance. He failed, however, to set forth any action which lime may have on the stucco in the killing process and the writer believes his statement will be questioned by a large number of specifiers and users of lime in stucco.

It seems quite probable that in condemning lime, Mr. Webb has failed to take into consideration all of the fundamental qualifications which a stucco must possess to be durable and the effect that lime has towards the improvement of these important qualifications. This article is therefore written with the idea in mind of correcting any erroneous impressions that may have been formed and to present sound reasons as to why lime, in stucco, in various percentages, is of sufficient value to warrant its use in all cement stucco construction.

The first point to which I call attention is that many manufacturers of portland cement and various lathing materials recommend in their printed specifications that lime be used. Surely no manufacturer would recommend that any material be used in connection with his own that would redound to the ultimate failure of his own material.

Exterior stucco is different from other materials used for exterior coating only in so far as it is mixed and moulded into shape at the site of the work, instead of being delivered in small units. Assuming that a stucco has been properly proportioned and mixed, and the building itself has been properly designed, braced, etc., in accordance with good stucco practice, then there still remains another factor which will have great bearing upon the quality of the stucco—the application—and a close study of stucco construction will prove this to be a very important factor.

To permit of application, a stucco material must be of a plastic nature. The more plastic a material may be, the less labor will be required to apply the material, and in these days of high labor costs one cannot fail to take this item into consideration. Therefore any material that can be added in various percentages (depending upon its other advantages to the stucco) which does not in any way act to the detriment of the stucco, and at the same time increases the plasticity of the mixture, is a logical material to use. This is the case with lime. It is the most plastic of all building materials and when introduced into the mixture increases the workability and permits better workmanship. When a bricklayer is asked why he uses lime in brick mortar, he will quickly answer "to make it work smoother." How often does one hear about brick mortar being "killed" when lime has been made a part of the mixture?

Aside from the value of economy in application through the medium of plasticity, let us consider what the relation may be between plasticity and durability.

The author of the article under discussion has recommended that metal lath be used as the backing material. All well-written specifications for stuccoing metal lath provide that the lath shall be well embedded in the stucco. The reason for this is obvious, for metal lath undergoing corrosion will cause disintegration of the stucco. Regardless of whether or not the metal lath is

coated or galvanized, it should always be firmly embedded, and what better precautionary measure can be relied upon for proper embedment than an extremely plastic stucco. As mentioned above, lime produces extreme plasticity.

This brings us to the importance of having the stucco watertight as another means of protection to the lath. This subject can best be disposed of by a statement that in an investigation of upwards of 40 paterproofing materials, conducted by the U. S. Bureau of Standards, hydrated lime was found to be the most efficient. This investigation is reported in Technologic Paper No. 3 of the Bureau of Standards.

Aside from the possible effect of moisture on the lath, the question of watertightness of the stucco will be a factor in determining the volumetric changes which the stucco will undergo when alternately wet and dried, which condition is imposed many times through a twelve months period. Expansion and contraction when caused by moisture changes is much greater than when caused by temperature changes. The logical conclusion then to arrive at is to have the stucco as watertight as possible—and this can best be done by employing the most efficient watertightening medium.

It may be of interest to readers to know that in an extensive field investigation, conducted recently by an accepted authority, resulted in stucco (containing 50% lime) being given an excellent rating. Also one of the best buildings examined was stuccoed with a material of which the cementing ingredient was 100% hydrated lime. In this investigation many structures were carefully examined in various cities from Chicago to Boston.

The question of the proper proportion of lime to use is governed largely by factors which have not been treated in this paper; in many cases the type of backing material warrants a high percentage of lime.

It is not the purpose of this article to lead anyone to believe that the use of lime in a stucco material is an assurance against defects; there are too many other governing factors—two of which are design and workmanship—which will determine freedom from defects, and these factors cannot be neglected. It is, however, its purpose to show that the use of lime in good stucco is not only safe practice, but highly desirable.

Lastly, manufacturers of the lathing material to which Mr. Webb gives preference—metal lath—recommend that lime be used.

Yours very truly,
HYDRATED LIME BUREAU,
Norman G. Hough,
Manager.

Cement Mills Increase Wages of Employees

Increase of wages of employees of the Northwestern States Portland Cement Company, and the Lehigh Portland Cement Company, of Mason City, Iowa, of two and a half cents per hour, effective October 15, was announced. Bulletins to this effect have been posted at the plants. Working on a ten hour schedule—and most of the employees put in a day of that length—it is an increase of twenty-five cents per day.

It is understood that other employees, whose compensation is figured on a basis other than that of a rate per hour, are also being remembered with increases in their pay checks.

Tests of Blast-Furnace Slag as Aggregate in Concrete

[In order to secure definite authoritative data on the use of blast-furnace slag in concrete, a number of leading interests, which either produce or market slag, made a co-operative arrangement with the Pittsburgh Testing Laboratory of Pittsburgh to conduct a series of experiments and tests that would extend ultimately over a period of five years.

The reports of these tests will be of more than ordinary value, as the care involved in the preparation and testing of the specimens made the tests more expensive than would ordinarily be undertaken by a commercial laboratory, and the results are such as can be obtained only by having a very carefully-organized research department.

Recognizing that these tests are of the utmost value to engineers in acquainting them with the performance of blast-furnace slag in concrete work, the Cement and Engineering News publishes herewith extracts from the report compiled by the Pittsburgh Testing Laboratory.—Editor Cement & Engineering News.]

The purpose of this series of tests was to furnish information relative to the use of concrete materials, as follows:

(1) A comparison of the crushing strengths of air-cooled blast-furnace slag, crushed stone and gravel when used as the coarse aggregate in concrete, tests to be made at the end of 14, 30, 60 and 180 days, 1 year, 3 years, 4 years and 5 years.

(2) To determine the granulometric analysis of the material as received, together with other physical characteristics.

(3) Determination of the corrosive tendency of sulphur in slag.

(4) Effect of sulphur and other elements on the durability of concrete up to the age of five years.

(5) Relative strength and durability of concrete made of high magnesia, low lime slag and low magnesia high lime slag.

The materials used as the coarse aggregate in these tests were secured from the following localities:

	PTL. Mark
Slag: Cleveland Macadam Co., Cleveland, Ohio (From A. S. & W. Co., Central Fur., Cleveland, Ohio)	87410
Slag: Duquesne Slag Products Co., Pittsburgh, Pa. (From C. S. Co., Duquesne, Pa., slag bank) ..	87420
Slag: Carnegie Steel Co., Pittsburgh, Pa., (From Ohio Works, Youngstown, Ohio)	87430
Slag: Northwestern Iron Co., Mayville, Wis.	87440
Slag: Standard Slag Co., Youngstown, Ohio (From S. F. Co., Sharpsville, Pa.)	87450
Slag: Cleveland Macadam Co., Cleveland, Ohio (From C. F. Co., Cleveland, Ohio)	87470
Slag: Birmingham Slag Co., Birmingham, Ala. .. (From T. C. & I. Ry. Co., Ensley, Ala.	87480
Slag: Duquesne Slag Products Co., Pittsburgh, Pa. (From E. S. Co., Pottstown, Pa.)	87520
Slag: The France Slag Co., Toledo, Ohio (From T. F. Co., Toledo, Ohio)	87530
Gravel: Allegheny River, from Pittsburgh, Pa. ..	87460
Trap Rock: From Birdsboro, Pa.	87490
Gravel: From Akron, Ohio	87500
Crushed Granite: From Stockbridge, Ga.	87510
Limestone: From Gates City, Ala.	87540
Dolomitic Limestone: Kelly Island, from Cleveland, Ohio	87550

It did not seem practicable to screen the fine aggregate and recombine to conform to Fuller's curve, or to use a combination of two or more sands which would make theoretically the best fine aggregate. The material selected was reasonably well graded, and the same sand was used throughout the series of tests, the whole amount

being secured at one time from the back channel of the Ohio River, at Neville Island.

The cement used was Alpha Portland, from Manheim, W. Va. This brand was selected by lot, being drawn from a list of several standard brands of Portland cement. All cement was purchased at the same time and sampled and tested before the preparation of concrete test specimens was begun. The results of these tests are included in the report.

As the various aggregates were received, they were screened through sieves consisting of iron plates with circular holes of the following diameters:- $1\frac{1}{4}$ inches, 1 inch, $\frac{3}{4}$ inch, $\frac{1}{2}$ inch and $\frac{1}{4}$ inch.

The portions retained on each of the above sieves were stored separately and labeled, to be later recombined to make the coarse aggregate used in the tests.

In accordance with the specifications, the coarse aggregate was recombined to conform to Fuller's curve. Since the portion of Fuller's curve representing coarse aggregate is a straight line, and since the curve is referred to ordinates, of which the vertical ordinate is divided into equal parts, showing percentages by weight, and the abscissa is divided into equal parts, representing the diameter of the particles in inches, it follows that coarse aggregates, when so recombined, will consist of equal percentages of the four (4) gradings, which increase in size uniformly from $\frac{1}{4}$ inch to $1\frac{1}{4}$ inches. All aggregates, therefore, were recombined by weighing equal quantities of the four gradings and shoveling them together, turning them until their appearance showed them to be thoroughly mixed.

In order to accurately proportion the concrete, the weight per cubic foot of all materials was determined. Since there is no generally-accepted method for determining the weight per cubic foot of concrete materials, one was used which had been found in the past to give consistent results. A cubic foot measure was filled loosely with either sand or the recombined aggregate, after which the measure was dropped 10 times on a felt pad one inch thick from a height of three inches. The measure was again filled and smoothed off with a straight-edge and weighed. The average of 10 determinations was taken as the weight per cubic foot of the material used. The variation of the individual determinations was usually within five-tenths of 1 per cent, and seldom over 1 per cent. The weight per cubic foot was frequently redetermined, to take into account any drying out of the material. The weight of the cement per cubic foot was taken at 100 pounds, this being in accordance with the generally-accepted figures for cement.

Void determinations were made on the various aggregates after recombining. Each coarse aggregate was thoroughly wet, drained and a cubic foot measure filled and weighed, as given in the method for determining the weight per cubic foot. Water was then slowly added until the measure was level full. From the increase in weight the percentage of voids was computed.

It was not possible to combine the sand and cement with the slag, gravel and crushed stone, respectively, to strictly conform to Fuller's curve and still have tests which would be comparable with each other on the basis of equal proportions of cement. It was, therefore, necessary to determine the leanest mixture which would produce a dense concrete when using the coarse aggregate having the highest percentage of voids, and then using this mixture for all materials. By this method the same quantity of cement was used to make each specimen, and the test data shows a comparison of the different aggregates under the same conditions.

The proportions for the mortar were determined by making trial mortars of various proportions of cement and sand and selecting the mixture giving the maximum

density as shown by increase in volume of the resulting mortar. After numerous tests, the proportions of 1 part cement and 2 parts sand were found to most nearly fulfill the tests for maximum density of the mortar.

The coarse aggregates used for these tests varied in weight per cubic foot from 64 to 104.5 pounds, and the percentages of voids from a minimum of 31.85 to 49.2 per cent. Since the percentage of voids in one case was 49, to obtain the maximum density, using this aggregate,

the mixture should be almost exactly two parts of mortar and four of coarse aggregate; this proportion would give some excess mortar in all of the other cases.

The fact that a 1-2-4 mixture is one which is very commonly used—and a large amount of data may be found for comparison—was an additional reason for using it in these tests.

These proportions by volume having been selected, the equivalent weight each of the materials for these propor-

NAME OF MATERIAL USED	WEIGHT OF MATERIAL USED	PERCENT Voids in MATERIAL USED	14 DAY TESTS				30 DAY TESTS				60 DAY TESTS				180 DAY TESTS			
			MARK ON CYLINDER	WEIGHT OF CYLINDER LBS. OZ.	CRUSHING STRENGTH IN LBS. PER SQ. IN.	PERCENTAGE INCREASE OVER 14 DAY	MARK ON CYLINDER	WEIGHT OF CYLINDER LBS. OZ.	CRUSHING STRENGTH IN LBS. PER SQ. IN.	PERCENTAGE INCREASE OVER 30 DAY	MARK ON CYLINDER	WEIGHT OF CYLINDER LBS. OZ.	CRUSHING STRENGTH IN LBS. PER SQ. IN.	PERCENTAGE INCREASE OVER 60 DAY	MARK ON CYLINDER	WEIGHT OF CYLINDER LBS. OZ.	CRUSHING STRENGTH IN LBS. PER SQ. IN.	PERCENTAGE INCREASE OVER 180 DAY
SLAG, CLEVELAND, CO. MACADAM, CO. CENTRAL FURNACE CLEVELAND, OHIO	66.5	49.2	9	62 8	1897	1941	10	63 3	2461	2525	8	63 00	2815	2930	7	62 10	3740	3753
SLAG, DUQUESNE, OHIO	78.5	42.74	18	65 10	2212	2159	17	64 4	2983	2657	4	65 6	3143	3117	7	64 12	4280	4315
SLAG, CARNEGIE STEEL CO. YOUNGSTOWN, OHIO	79.3	43.15	18	65 13	2318	2134	17	64 00	2568	2657	12	65 10	3220	3306	16	65 10	4130	4154
SLAG, NORTHWESTERN IRON CO. YOUNGSTOWN, OHIO	64.5	45.87	20	65 8	1946	2206	27	65 1	2562	2653	22	65 4	2810	3403	20	65 5	4452	4309
SLAG, STANDARD SLAG COMPANY, SMARSHVILLE, PA.	75.0	41.53	2	62 12	2238	2484	3	63 00	2640	3075	5	62 5	3523	3365	1	62 15	4906	4803
GRAVEL, ALLEGHENY RIVER PITTSBURGH, PA.	104.5	31.85	12	62 12	2141	2046	13	62 12	2630	2510	18	63 00	3363	3289	5	63 3	4678	3969
SLAG, CLEVELAND FURNACE CLEVELAND, OHIO	64.0	46.77	22	63 4	2238	2257	27	63 4	2688	2844	21	64 13	3268	3288	6	63 0	4512	4394
SLAG, BIRMINGHAM, ALA.	83.8	42.00	2	62 4	2387	2109	1	66 9	2660	2752	6	68 13	3427	3289	7	68 14	4200	4451
TRAP, DOCK, BIRDSBORO, PA.	98.7	41.93	12	62 4	2237	2063	11	61 8	3057	2386	14	62 1	3126	3360	6	61 15	4588	4819
GRAVEL, AKRON, OHIO	95.0	35.9	22	61 11	2146	1795	21	62 5	2666	2078	24	61 2	3068	2554	13	61 14	4422	3627
CRUSHED GRANITE, STOCKBRIDGE, GEORGIA	90.0	42.34	2	66 13	2043	2122	1	66 9	2660	2292	8	64 00	3270	3043	3	66 2	4432	4151
SLAG, DUQUESNE, OHIO	73.75	43.55	12	68 7	1800	2187	11	67 9	2800	2650	16	66 9	3354	3289	4	66 9	4460	4184
SLAG, FRANCE, OHIO	81.75	42.5	22	67 10	1792	1942	21	67 8	2153	2536	28	67 14	3257	3103	16	68 0	3404	4164
LIME, STONE, GATES CITY, ALABAMA	94.87	40.33	11	69 00	1980	1713	1	69 00	2230	1988	3	69 2	3112	3082	8	69 6	4190	4127
DOLOMITIC LIME, STONE, KELLY'S ISLAND, CLEVELAND, OHIO	94.11	38.71	12	68 00	2178	1804	11	68 4	2334	2360	14	63 00	3244	3604	4	63 6	4205	4724

tions was determined, and throughout the series of tests all materials were weighed, and greater accuracy in proportioning thus obtained. The mixture, however, is by volume, the method of weighing being used only to insure more accurate proportions.

A quantity of material sufficient to make ten (10) cylinders was mixed at one time, the sand being spread in a flat pile and the cement placed over this. The two materials were turned by two men until the color appeared to be uniform, three or four turnings being required. The coarse aggregate was then shoveled on this material and the whole turned dry three times. During the fourth turn a weighed amount of water was added from a sprinkling can and three (3) additional turnings given the mixture. During the last three turnings small quantities of water were added as needed until a "quaking consistency" was obtained. In all mixtures an attempt was made to secure the same consistency, regardless of the amount of water used. For this reason, it was not possible to use a mechanical mixer, as the quantity of water is very important, and in mechanical mixing the material may be made too wet and the whole batch spoiled for laboratory purposes. It is noteworthy that care must be used to obtain the correct consistency, and that the addition of 1 pound of water to a 10-specimen mixture would give a consistency too wet, usually described as "mushy," and the results of the tests would be unsatisfactory.

The specimens were made in steel molds 8 inches in diameter by 16 inches high. The concrete was poured into these molds in layers 4 inches thick, and each layer

(1) It will be noted that one-half of the tests of the slag concrete, were made using slag produced by the quick-cooling process, in pits, in which the slag is shipped within a few days from the time it comes from the furnace, and the remainder from slag which had been seasoned in banks for a period of six months in some cases and as much as 15 years in one case.

(2) The length of time during which this series of tests has been conducted does not warrant the drawing of any definite conclusions, but the general uniformity of the results of the crushing tests of the concrete should be observed.

(3) Slags coming from furnaces many hundred miles apart, varying quite widely in chemical analyses, and also varying considerably in the weight per cubic foot, do not vary in strength in proportion to either the weight or percentage of any chemical constituent.

A Successful Michigan Gravel Plant

The Detroit Oxford Gravel & Stone company, producers of gravel and crushed cobbles, with plants at Oxford, Mich., is the pioneer company in the Oxford district and one of the largest organizations of its kind in Michigan, having an authorized capital of \$50,000 paid in. In the gravel line, it specializes in both the washed and bank run.

The washed gravel is graded to various sizes required in reinforced concrete work, roofing and other purposes. Road gravel is not washed, but prepared

CHEMICAL ANALYSES OF AIR-COOLED BLAST FURNACE SLAG.

PTL Laboratory Number.....	87410	87420	87430	87440	87450	87470	87480	87520	87530
Silica	35.35	36.72	34.35	31.98	35.74	33.63	35.55	31.53	35.15
Alumina	12.28	12.81	13.55	12.25	11.81	13.41	12.04	12.39	14.11
Iron Oxide	0.90	1.50	1.02	2.00	0.38	1.25	0.62	0.50	0.25
Manganous Oxide	0.50	0.61	0.71	0.34	0.70	0.40	0.36	0.22	0.43
Titanium Oxide	0.40	0.33	0.50	0.30	0.30	0.40	0.40	0.55	0.45
Calcium Oxide	40.05	40.98	45.80	31.75	42.65	39.18	41.35	32.78	38.75
Magnesium Oxide	8.20	5.14	1.62	19.43	6.18	9.31	8.45	18.24	8.84
Sulphur in Calcium Sulphide.....	1.05	1.29	1.10	0.89	1.26	1.03	0.73	0.89	1.11
Sulphur in Calcium Sulphate.....	0.52	0.27	0.41	0.27	0.24	0.20	0.50	0.10	0.17
Sulphur in Other Forms.....	....	0.12	....	0.07	....	....	0.05	0.18	....
Carbon .....	....	....	....	....	....	....	....	0.62	....

tamped thirty (30) times with a $\frac{7}{8}$ -inch round rod. After the second and fourth layers the sides were spaded with a large trowel. These cylinders were finally finished at the top by spading with a small trowel to form a smooth upper rim, and a piece of plate-glass placed on top to form a smooth surface. Since the concrete would settle slightly after a few hours, it was necessary to cap the top of the specimen with plaster of paris and cement and again place the plate-glass on the cap to make a smooth surface.

The specimens were kept in the molds for forty-eight (48) hours and then stored in damp sand for thirty-five (35) days. At the end of this time all specimens were removed and stored in air. Four (4) short pieces of reinforcing steel were embedded in each of two (2) cylinders from every batch.

These pieces were 3, 6, 9 and 12 inches long, and were cut from $\frac{1}{2}$ -inch twisted reinforcing bars furnished by the Carnegie Steel Co., Duquesne heat No. 99439, having the following chemical analysis:

Carbon	20 Per Cent.
Manganese	45 Per Cent.
Phosphorus	.018 Per Cent.
Sulphur	.046 Per Cent.

These specimens will be examined at the end of the five-year period to determine the corrosive action of the aggregates.

from the "bank run" material, oversize gravel and cobble stone, being out through a crusher. This provides a road material of splendid quality, which runs 85 per cent "metal," which is 10 per cent more than the state specifications require.

The company has more than 7,000,000 cubic yards of gravel available. Detroit is the principal market for the product.

W. O. Smith, the founder of the company, and who has been closely allied with the production and marketing of gravel in the Detroit district during the last 12 years, is secretary and manager. The president is Frank W. Hubbard, of Grosse Pointe Farms, Mich.

Because of the shortage of cars, and only box cars being available for loading this season, the company found it necessary to temporarily suspend operation of its washing plant, and has confined its operations wholly to bank run concrete and road gravel in loading available cars.

The company operate 4 Gates crushers; 24" Symons disc crusher; 4 steam boilers and use Sawyer canvas belting. The product derived from the Symons disc crusher, the company declare, is all that can be desired. They only use it for recrushing and find it quite satisfactory. The power required is fairly low. They have been operating their Symons crusher for the past five years.



Reconstructing a Storm-Water Sewer. The Concrete Mixer Is Easily Moved Along to Keep Abreast of the Job

Methods of Constructing a Storm—Water Sewer

The city of Cincinnati recently placed a contract with Mr. J. J. Foley, contractor of Cincinnati, Ohio, for rebuilding the 11-foot diameter brick storm-water sewer along Mitchell avenue.

The contract covers 955 feet of work, 270 feet of which is in tunnel. The specifications call for the top to be taken off the old brick sewer to the spring line and the construction of a box top of concrete on the old bed, so as to make a 17-foot sewer out of it.

The bottom of the old sewer had to be raised several feet. This necessitated the construction of cofferdams and flumes, one of which is shown in the lower center of the illustration. After taking the sediment out of the old sewer the new concrete bottom was placed directly on the old brick floor.

A steam shovel was used in excavating the soil above the old sewer and the dirt taken out was all piled up on the north side to give an elevation high enough for spouting the concrete down directly into the forms by the gravity system.

Mr. Foley is using a Cincinnati Paving Mixer of the self-tractor type, manufactured by the Ideal Concrete Machinery Co., 1353 Monsworth avenue, Cincinnati, for his concrete work. As this Mixer is easily moved along to keep abreast with the job, it eliminates the expense of construction runways for wheeling the concrete to the forms.

The illustration shows how the discharge chute of the paver was coupled up to the spouting system.

Owing to the efficient methods of handling this contract, Mr. Foley will undoubtedly complete it fully six months ahead of the time estimated and allowed by the City Engineers.

Cement Company Erecting New Potash Recovery Plant

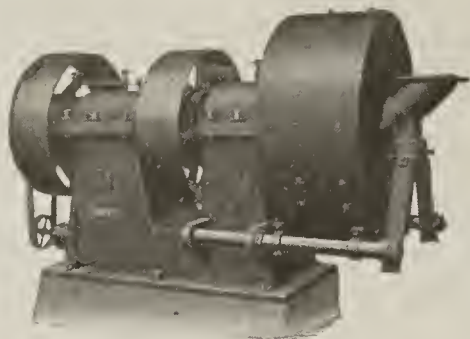
Work has been started on the new potash recovery plant of the Clinchfield Portland Cement Corp., at Kingsport, Tenn. This plant will employ the Cottrell or electrical precipitation system in its latest form and will include a wet treater by means of which potash salts will be obtained. Incidentally it may be said that the wet treater is not only less expensive to install than the dry treater heretofore employed but the potash salts obtained by it bring a much higher price per unit than the potash bearing dust from the hydrator. There will also be a much better market for the salts than for the dust after the war is over and the German product comes back to this country. In the plant at Kingsport the engineers have worked out a system by means of which the evaporation of the solutions will be effected by means of the waste heat from the kilns. Richard K. Meade & Co., Consulting Engineers of Baltimore, Md., are the designing and constructing engineers for the plant.

Symons Disc Crusher

Adjustable, Centrifugal Feed, with Manganese Discs

The Symons disc crusher consists essentially of two discs, A and B, held in place by two shafts, one of which is hollow and contains the other. The large ball-and-socket connection of the shafts allow their axes to be set at an angle to each other. The outer disc, A, is held in a cap firmly fastened to the bell-shaped end of the hollow shaft C, and is driven by the belt wheel D. The inner disc, B, supported by the half ball and solid shaft inclines to rotate with the disc A, though not positively driven when the machine is running empty. When stone is fed between the discs, they both rotate together in the same direction, at the same speed, producing the crushing action.

This crushing effect is quite independent of the eccentric E, and would be carried on if the latter remained at rest. This eccentric comprises the hub of the pulley F, which is driven in a direction opposite to that of the pulley D. The function of the eccentric is to increase the rapidity of the crushing action, or closing of the discs. The outer end of the solid lever shaft is carried around in one direction by the eccentric E, while both shafts are rotating together in the other direction. The two shafts and discs attached rotate at the proper speed to force the feed and fling out the product. When stone is fed through the central feed opening it is thrown by centrifugal force into the space



Symons Disc Crusher

where the discs are widest apart. It is carried around with them to where they are closer together and is crushed in the operation. The smaller particles fly out from between the discs, into the encircling chute, while the larger particles are caught again and the operation repeated.

A number of important and exclusive advantages are claimed for this crusher. It will take the rejections, screened or unscreened, from standard gyratory crushers and reduce them at one operation to $\frac{3}{4}$ -inch size or less. It will reduce wet or dry gravel boulders mixed with sand to the smaller product. It can be quickly adjusted to make any standard size of product down to $\frac{3}{8}$ -inch, as desired. The reduction is accomplished without any grinding movement or dangerous wear.

The support of the feed spout is adjustable and the spout is elliptical in section. The hood casing completely encloses the crushing members to prevent escape of dust. This casing is divided vertically, each half being hinged on a supporting shaft.

Congestion and choking is avoided because the stone is spread by the centrifugal effect between the discs. The stone is thrown out the instant it is reduced to the proper size.

The crushing members are of manganese. They wear smooth, not in grooves, and may be set closer together to take up wear. This gives maximum service. The main crushing load is on the large ball and socket bearing, having little movement.

The bearings are positively dustproof. The shaft and eccentric bearings operate in a bath of oil. The heavy frame forms an oil-tank from which oil is forced through these bearings by the oil pump at the rate of several gallons per minute. The oil is returned directly to the tank without loss. The hollow shaft comprises a reservoir from which oil is supplied to the large ball-and-socket joint.



Disc in Action

The crusher is made in four sizes—18, 24, 36 and 48 inch. The corresponding sizes of feed are $1\frac{1}{2}$, $2\frac{1}{2}$, $3\frac{1}{2}$ and $6\frac{1}{2}$ inch. The minimum capacities range from 5 to 15, 12 to 30, 25 to 65 and 45 to 120 tons per hour.

The accompanying illustrations show the disc principle and small size crusher. The crusher is made by Chalmers & Williams, Inc., Chicago Heights, Ill.

Two Link-Belt Announcements

The Link-Belt Company, 39th St. and Stewart Ave., Chicago, has issued Folder No. 340 describing the Link-Belt sand and gravel washery at the plant of the Raritan Ridge Clay Co., Metuchen, N. J., and Book No. 343 concerning the Link-Belt rope tramway system, each of which is adequately and informingly illustrated. The sand and gravel washery is a good example of the moderate-sized plant, with machinery to handle 50 cubic yards of material per hour and deliver clean-sized product direct to railroad cars. Electric motive power is employed to operate the washery. The tramway and tower system is of the Watson type and the book says that the company, after many years of study and experience with both rope bridges and man trolleys, has developed a rope system which embodies all of the good features of the man trolley, and, in addition to eliminating the heavy carriage, makes possible higher speeds and easier and more certain control, while at the same time permitting of a substantial reduction of power demands and cost of installation. The first cost is considerably less than that of a man-trolley.

Chief Chemist for Western States Cement Plant

Guy Blackmore, assistant chemist at the Northwestern States Portland Cement plant, recently left for Independence, Kas., where he has accepted a position as chief chemist in the Western States Cement plant. George Ivan has been secured to fill the vacancy at the Northwestern plant.



Concrete Cottages for Railroad Employees

Few railroads have attempted a solution of the housing problem as it relates to their employees by using concrete as extensively as the Los Angeles & Salt Lake, which has constructed cottages for section foremen and laborers and for other employees on various points on its line, according to standard plans, using monolithic concrete in some cases, and in others concrete block.

In 1910, the company built for shop employees in Las Vegas, Nev., 20 four-room and 20 five-room concrete cottages with shingle roofs. The average cost of these was \$1,650 for the four-room and \$1,800 for the five-room cottages. While simple, the plans provide the recognized conveniences of the modern well-appointed home, including a bath room. In 1911 work was started on 12 more four-room and 12 five-room cottages on the same plans. In this second lot there was a slight reduction in the cost. The four-room cottages cost an average of \$1,600 each, while the five-room averaged \$1,750 each.

One of the photographs shows a concrete rooming house built for the accommodation of single men employed at the company's shops in 1911. It is two stories high, contains 32 rooms, is roofed with composition material, has a sleeping veranda, and is equipped with steam heat, laundry, baths and other modern sanitary appointments. The cost approximated \$28,000.

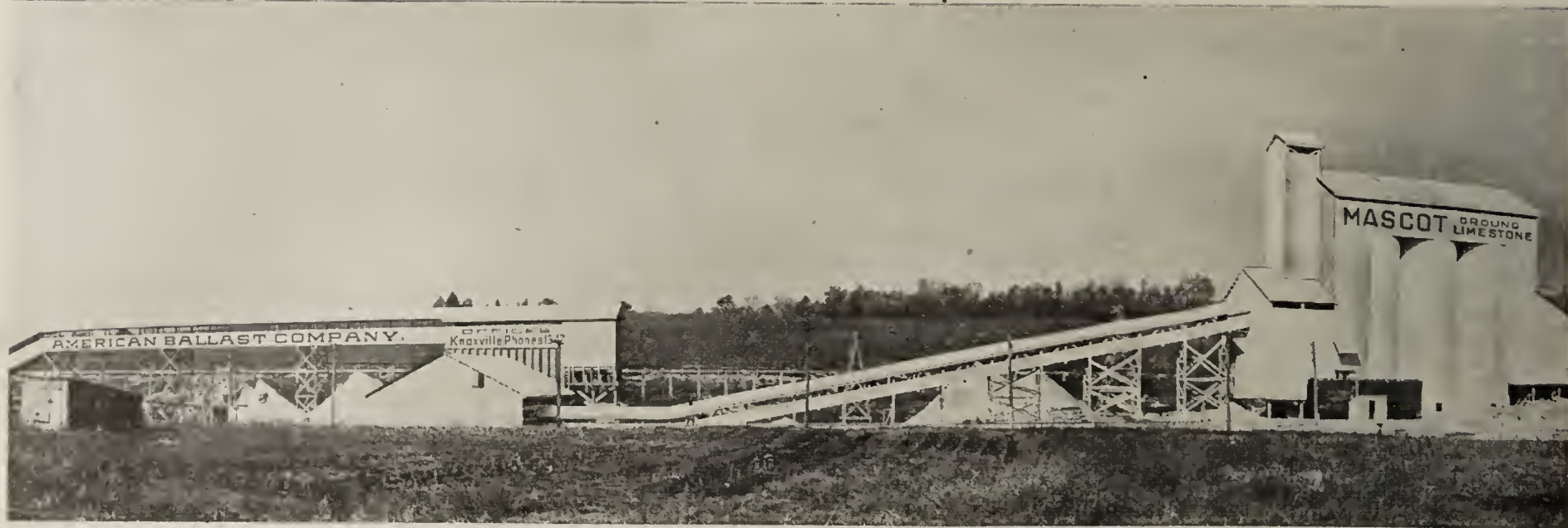
Other photographs show various types of quarters provided for section laborers and section foremen. Between Los Angeles and Riverside these houses are of monolithic concrete with composition roofs. On the desert, between Daggett and Caliente, a slightly different type of house was adopted, the principal change being the addition of a patio for ventilation.

The company purchased a concrete block-making machine in 1909, which manufactures a type of block that enables a wall to be built with a continuous air space throughout. The particular advantage of this type of block lies in the fact that the resulting hollow wall introduces insulation in the wall through this dead air space. This prevents extremes of heat and cold on the exterior from materially affecting the temperature within the structure.

An important advantage of concrete for section laborers' quarters is that the necessity for maintenance is almost eliminated. This fact deserves particular consideration because much of the labor is foreign and is unmindful of sanitary requirements in the home and is naturally, even if unintentionally, destructive of the quarters in which he lives.

Cars to Be Furnished to Shippers Who Load Heaviest

The Portland Cement Manufacturers association have passed resolutions urging that carriers be required by law to give preference in supplying cars to the shippers who load heaviest and release cars the promptest. The resolutions were adopted at the Chicago convention and forwarded to Judge R. S. Lovett, in charge of priority shipments, and to the executive committee of the national car service commission. The resolutions express the belief that if all the shippers do their best in utilizing equipment to the best advantage, there will be plenty of cars and locomotives to meet all needs.



Modern Limestone Plant of the American Ballast Co., at Mascot, Tenn., Owned by the American Zinc Co. of Tennessee, Who Operate Symons Disc Crushers for Crushing Mineralized Magnesia Limestone or Dolomite

Modern Limestone Plant in Eastern Tennessee

During the first seven months of 1917 the American Ballast Co. of Knoxville, Tenn., which has one of the largest plants in the South making ground limestone, has sold three times as much of its product as it did in the same period last year, and states that its shipments during the balance of the year will be limited only by the car supply.

The company's plant, an illustration of which is given, is located at Mascot, Tenn., 13 miles east of Knoxville on the Southern Railway. It has a capacity of 500 tons of ground limestone daily, and this is now being doubled. The rapid increase in the use of ground limestone by the farmers of the South is due to the patriotic appeals to them to increase their crops and to the persistent campaign of education as to the value of ground limestone as a fertilizer, carried on by national, state and quasi-public corporations.

The American Ballast Co., which has a thoroughly modern plant, is selling its "Mascot" ground limestone mostly in the Carolinas, Tennessee and Georgia. It sells its product direct to farmers, and while its salesmen are soil experts, it recommends that farmers secure advice from county agricultural agents, maintained in all of the states named, as to the requirements of their soil.

This company also has a large production of crushed stone, handling 3,000 to 4,000 tons daily. This is sold for concrete, ballast, asphaltic concrete, roofing gravel, going all over the South as far as Tampa and Miami, Fla. The latest addition to its line is limestone dust, which is being used for an asphalt filler, meeting not only the physical requirements, but, according to the report of Dow & Smith, chemical engineers, New York City, it shows passing 200 mesh, 84.5 per cent; passing 100 mesh, 14.5 per cent; passing 80 mesh, 1 per cent. Solubility in hydrochloric acid was 89.35 per cent mostly carbonate of lime. Dow & Smith further said: "This is an absorbent limestone dust very finely ground, and one of the best limestone dusts we have examined for asphalt filler."

Owing to the steady increase in the use of asphaltic surfaced roadways and streets, the company expects to have a continual and substantial growth in the sale of this filler.

The home office of the company is at Knoxville, Tenn., with Thomas McCroskey as general manager.

Concrete Pavement

Announcement has been made that specialists in the office of public roads of the United States department

of agriculture have just completed a seven-year study of cracks in concrete pavement. This may seem a small matter to spend seven years on, but the department of agriculture specialists believe that their study of the causes of this trouble will make the cracks a less baffling problem to builders hereafter.

Observing particularly the expansion and contraction due to alternate wetting and drying of concrete, records were made of the values of these moisture and temperature movements under various conditions. A waterproof covering, such as coal tar, it was learned, prevents a rapid change in moisture and greatly retards the expansion and contraction.

Other important results, which should be of value to road builders, are contained in a recent report of the investigations, Bulletin 532 of the department of agriculture.

Cannot Get Cars To Ship Gravel Or Stone

Sand, gravel and crushed stone producers and dealers and road contractors received a severe jolt on November 1st when the Priority Board of the Counsel of National Defense issued an order to the effect that open-top freight cars except flat cars could not be used after the above date for shipping materials and supplies other than coal for the construction, maintenance or repair of public or private highways and roadways. This order, while undoubtedly issued for the good of the country at large, will undoubtedly work a great hardship on the thousands of contractors who have work which is still unfinished and which involves millions of dollars. Of course protest has been made by a number of influential organizations to stay the order until at least December 15th, but up to the present time the railroads have made an arbitrary ruling on the same. Undoubtedly the need for coal is great, but from an observer who has the opportunity of studying the situation it would seem as though a shortage of motive power was very evident in handling the coal cars at the railway terminals and, therefore, of course, the railroads are unable to return the cars of the above description to the mine as quickly as they should. We are confident the board will be fair in their ruling and will not jeopardize the interests of the road contractors throughout the country without due consideration.

The Grant Rock Gravel Company at Fresno, Cal., have helped out the contractors in their territory by getting flat cars from the railroads and furnishing their own gondola sides for them. This has allowed some contractors who were shut down to resume.

Oregon Diatomite as Puzzolana for Portland Cement

The Diatomite Company, 623 Worcester Bldg., Portland, Oregon, write us as follows: "We own a large deposit of material in Central Oregon called Diatomite (or Kreselguhr) and when blended with Portland cement combines with part of the lime of the cement, making it more nearly waterproof, increasing its strength, and rendering it indestructible in salt water and sewage acids.

Puzzolana Portland Cement

Puzzolana Portland Cement is a Portland cement blended with some material containing Soluble Silicic Acid. Ordinary Portland cement contains about 63% of lime, 22% of silica, and 7% of aluminum as its essential elements.

The predominance of lime seems necessary to our process of manufacture, but in the finished product it appears to be superfluous to the extent of 30%, and even injurious to the Portland cement. The Soluble Silicic Acid of the Puzzolana neutralizes and utilizes this free lime, increases the strength of the Portland cement, makes it more nearly water-proof, and renders it indestructible in salt water and sewage acids.

In proof of these facts we quote from the highest authority on Portland cement:

INTERNATIONAL ASSOCIATION FOR TESTING MATERIALS
PROCEEDINGS, SIXTH CONGRESS
New York, 1912

Diatom-Earth as Puzzolana for Portland Cement

(By A. Poulsen, Chief Engineer to Danish Government Maritime Works, Denmark.)

"My experiments in the use of diatom-earth as puzzolana have given excellent results, and I have come to the conclusion that diatom-earth should be dried very thoroughly and then mixed (in proportions determined by chemical analysis) with the cement clinkers, so that the two substances can simultaneously be ground fine. In this manner we obtain a perfectly homogeneous product which will harden (set) under water, without segregating free lime, with the consequent disadvantages. * * *

"As is well known, the superfluous lime (CaO), which may be estimated to constitute 30 per cent of the weight of Portland cement, causes bad exudations from concrete through which rainwater or other water can percolate. In water mains or reservoirs it makes the water calcerous and the concrete leaky. In SEA WATER the lime becomes the direct cause of spoiling the concrete by attracting sulphuric acid (SO_3) and forming a double salt with the alumina of the cement (Al_2O_3). This aluminous salt $\text{Al}_2\text{O}_3, 3\text{CaO}, 3(\text{SO}_3, \text{CaO})$, calcium-sulpho-aluminate, crystallizes with quite a large quantity of water ($30\text{H}_2\text{O}$) and disintegrates the mortar, as has been experienced in many concrete installations in salt water, which after 20, 10 or even a smaller number of years, have proven to be so 'rot-fingers'. * * *

"Volcanic puzzolana has hitherto been used in order to overcome these difficulties. But since this substance contains, in addition to the silicic acid, with its beneficial properties, a several times greater quantity of useless sand and other superfluous matter, it is impossible, with most kinds of volcanic puzzolanas, to add the quantity of silicic acid necessary to neutralize the superfluous lime in the Portland cement without overcharging the mortar with 'dead' or ineffective matter which impairs the strength of the mortar. It is therefore fairly customary to use only a fraction of the quantity of puzzolana which would be chemically proper,

thus retaining a part of the free lime and its consequences, or not to use any puzzolana at all.

"This is not necessary when diatom-earth is used as puzzolana. Its great abundance of reacting silicic acid makes it possible to apply as much as is chemically desirable without thereby overcharging the mortar with useless matter; and since the silicic acid of the puzzolana, together with the lime of the Portland cement, form a good binding element in the mortar ($\text{SiO}_2, \text{C}_2\text{O}$), the diatom-earth cement has a greater mechanical strength than the cement proper, and a still greater strength than the strass-cement mixtures. This is proven by the experiments I have made at the Danish States Testing Laboratory in Copenhagen in 1910 and 1911. * * *

"It will stand storage just like normal Portland cement, and will meet all the demands placed on this cement with respect to binding properties, setting (naturally under constant moistening during a few weeks, or entirely under water), constancy of volume, and other tests, such as Erdmenger's or Le Chatelier's boiling tests, etc. Feret's rapid test of the resistance to the action of sea water have, up to now (June, 1912) given the result that the cubes of diatom-earth mixture kept eight months in a solution of sulphate of magnesia remained perfectly uninjured, while the corresponding Portland cement showed damaged edges after 10 to 13 weeks, and strass mixtures after 3 to 8 months. * * *

The puzzolana used by Mr. Poulsen and referred to in the above paper was German pieselguhr containing about 43 per cent soluble silica, but by treatment this percentage was increased to 51 per cent.

Mr. H. Duree, in a paper read at the above congress said in part:

"It may not be generally understood that the high proportions of lime contained in Portland cements cannot be appreciably lowered in the process of manufacturing Portland cement; for if a lower-limed mixture is burned, it will either melt or on exposure to air the clinker will 'dust' or disintegrate to a powder having little cementing value. The writer's proposal, therefore, is to add silica to the cement after it has been burned, and in such a manner as to facilitate its combination with the excess of lime that is liberated when water is added."

The experiments made by these eminent scientists have been partially duplicated at the University of Oregon, using Diatomite from our deposit containing 68.44 per cent of soluble silica. As naturally would be expected these experiments show even higher results.

Dr. McAlister, dean of the Engineering Department, University of Oregon, made the following report:

"Relative to the diatomaceous earth which you brought to the university last fall, the following results have been obtained: A portion of the earth, after being crushed and coarsely ground, was mixed with an equal volume of 'Olympic' Portland cement and the mixture was then finely ground in a pebble mill. This finely ground mixture we call a 'blend.'"

"Tentile briquettes were made with this mixture or blend and standard sand in proportions of 1:3 by weight according to standard methods of testing cement. For the purpose of comparison, briquettes were also made at the same time and in the same manner with Olympic cement and standard sand. The tensile strength of the briquettes is shown in the following table.

"Mortar briquettes 1:3 by weight. Tensile strength pounds per square inch.

Age	7 days	14 days	21 days	28 days	6 w'ks
Olympic cement.	341	398	—	475	501
'Blend'	356	432	470	521	554

"You will note that the blend is stronger than the cement from which it is made, and also that increase of strength with age is more rapid in case of the blend than in case of the cement.

"The cement used is a very excellent brand and gives strength far in excess of standard requirements. I am intending to experiment further to find how large a proportion of the earth can be ground with the cement without reducing the strength of mortar briquettes below standard requirements.

"Very truly,
"(Signed) E. H. McALISTER."

Subsequent tests made here at Portland indicated results as follows:

Portland cement and Diatomite blended equally by weight—

	7 days	28 days
Neat	210 lbs.	448 lbs. per sq. in. tensile strength
1:3 Sand.	292 lbs.	443 lbs. per sq. in. tensile strength

One pound Portland cement with two pounds Diatomite—

	7 days	28 days
Neat	180 lbs.	348 lbs.
1:3 Sand.	185 lbs.	310 lbs.

Thus it will be seen that when this Diatomite is blended with half its weight of Portland cement it tests 310 pounds tensile strength per square inch, which is about 35 pounds stronger than Government requirement for Portland cement.

However, the maximum results are obtained when just enough Diatomite is used to furnish sufficient silicic acid to neutralize and utilize all of the free lime in the Portland cement. This should be ascertained by chemical analysis of the Portland cement used and verified by actual tests.

The value of Puzzolana materials depend on the per cent of soluble silicic acid contained. Rhine Stross contains about 22.6 per cent, some American Tufas 28 per cent, foundry slag 32 per cent, and German Diatomite 43 per cent, which may be increased to 51 per cent by treatment. Our Diatomite contains 68.44 per cent of soluble silica as it comes from the deposit, which gives it a phenomenal value as Puzzolana for Portland cement.

Conclusion

Puzzolana Portland cement when properly made is (1) stronger than the Portland cement from which it was made, (2) it is more nearly water-proof, (3) it will withstand the action of sea-water and sewage acids, due to the fact that there is present no free lime for them to attack, and (4) the Oregon Diatomite is ideal for this purpose as it contains a maximum of soluble silicic acid and a minimum of dead or inert matter.

Road Building Tied Up

Revocation of Shipping Embargo to Be Sought.

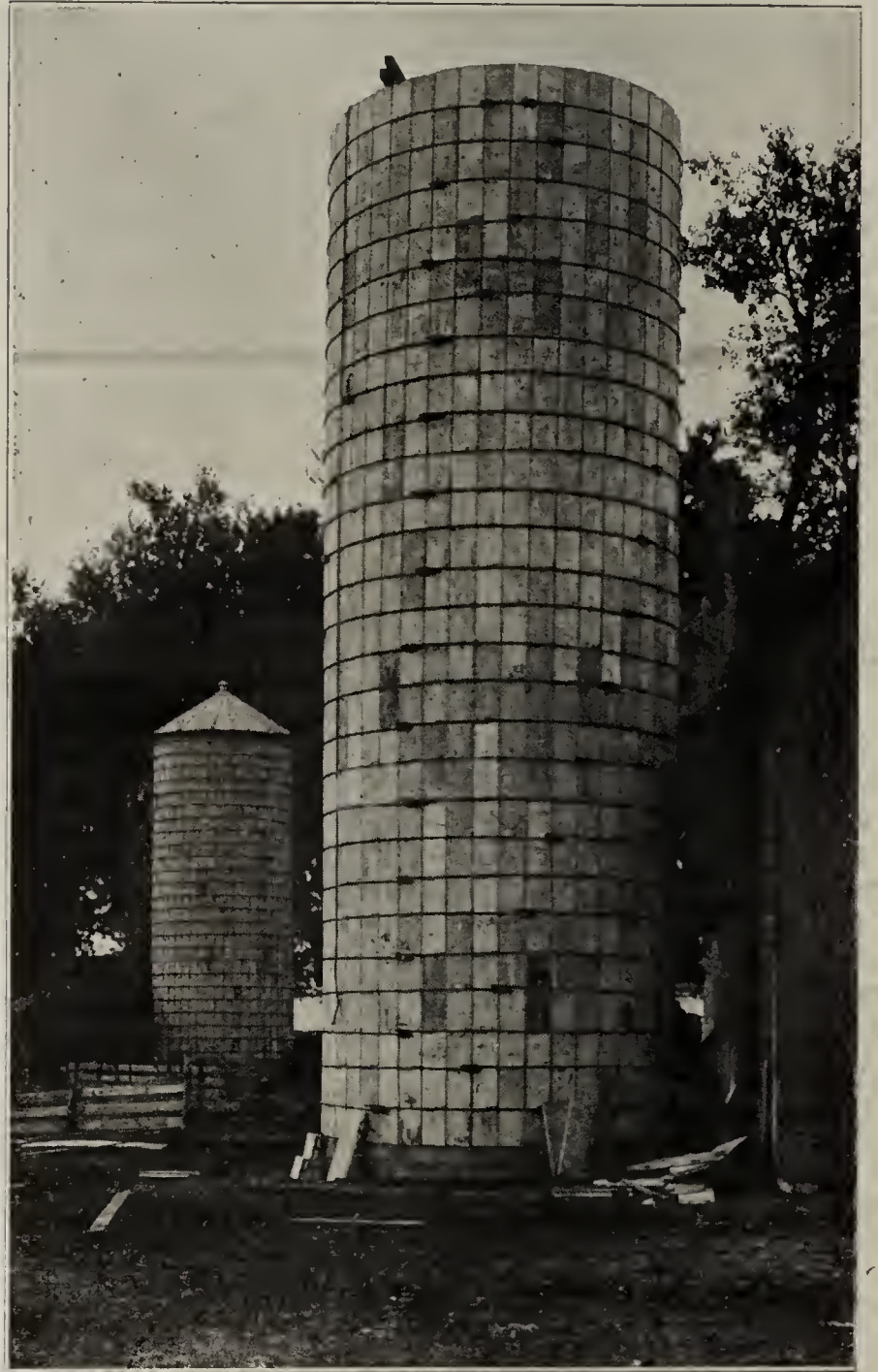
Good roads federations, automobile clubs and road builders have joined in a movement to ask United States Coal Administrator Garfield for the annulment of priority order No. 2 of the federal government, which places an embargo on the shipment of road and street paving material in open cars.

The continuation of the order through the winter and spring months would stop the entire 1918 road and street improvement program throughout the country.

A Real Interlocking Joint in Stave Silo Construction

The value of a stave silo depends to a large extent on the joint that is maintained between the staves, both at the ends and at the sides. If the joint is not perfectly tight and interlocking the silo cannot be as strong or as satisfactory as it should be.

The silo illustrated here in the process of construction is built with staves made on the equipment of the Co-Operative Concrete Construction Company. This concern has a joint between the staves that should give complete satisfaction. The ends of the stave are offset



1½ inches and are tongued and grooved at both the sides and the ends. The offset gives a very strong, rigid joint that will brace the walls, and yet is flexible enough so that expansion and contraction can be accommodated.

The outside of the staves is made slightly convex for a very good reason. It allows the iron bands to fit closely against the staves and not touch merely at the corners so the resistance to expansion and contraction will not cause breakage. The bands are placed around the silo 15 inches apart so that each stave is held on by three bands.

The manufacturers of this equipment are located at Oskaloosa, Iowa, and can be addressed at Box 908. They will be glad to furnish further details on request.

Concrete Illuminating Standard

Concrete lamp posts are coming into greater prominence daily in Pittsburgh, and their use is not being restricted to the business area of the city. University Road, which leads through the beautiful campus of the University of Pittsburgh in the Schenley section, is shown in the accompanying photograph.

The standards dotting the margin of the street shown are all made of concrete from plans made in the Bureau of Engineering, City of Pittsburgh, N. S. Sprague, Chief Engineer, by Stanley L. Raush, Designing Architect.

From the standpoint of artistic harmony, which is a desired feature with landscape architects, there is no other combination so complete as the blend of colors of the concrete walks, curbs and standards.



Concrete Lighting Standards on University Road, Pittsburgh, Pa.

The harsh effect of a metallic structure is entirely eliminated.

The standards in the accompanying views can be used to house both gas and electric systems; gas being at present used as the lighting medium. By wiring the $\frac{3}{4}$ " duct used for gas and by attaching electric equipment, University Road could at any time, on short notice, be lighted electrically.

Specifications for these standards required that the posts be cast in metal forms. One part Portland cement, two parts crushed aggregate and 10% coarse, clean, white sand was used in the concrete mixture. The crushed aggregate was one part "Terrazo No. 2" (crushed black Italian marble) and two parts crushed granite or trap rock passing a $\frac{1}{4}$ " screen. Forms were removed after 24 hours and the surface lightly scrubbed with muriatic acid and water, which removed the film of cement and exposed the aggregate.

The artistic appeals to the eye and the economical to the pocketbook. Here is a case of double affinity since the cost of the concrete standards to the City of Pittsburgh was only $33\frac{1}{3}\%$ (one-third) of what metallic would cost. One hundred posts of the detail herein shown were constructed, erected and fully equipped for lighting at an average cost of \$43.40 each, the average cost of cast iron posts being \$131.00.

Car Shortage Situation

The car-shortage situation is becoming less acute in most parts of the country in spite of increased transporta-

tion needs. This is partly because of measures taken by the railroads to expedite the movement of freight cars, but is more particularly the result of the campaign for educating shippers. After many years of experiencing a car shortage during part of almost every season and frequently during most of the year, we have suddenly waked up to the fact that freight cars, on an average, are loaded to about half their capacity. A comparatively small increase in car loadings would eliminate the present shortage entirely. Furthermore, consignees are only too fond of economizing on warehouse space by using cars instead. One form of engineering construction that should not be halted by the war is the construction of warehouses and other storage facilities so that freight cars on arriving at their destination may be unloaded promptly and released for their proper work of transportation.

Receiver Again Asked for Cement Company

Renewal of hostilities in the Superior Portland Cement Company of Cincinnati is signaled in the suit in the United States Court by Mrs. Frances Williamson, charging that Justis Collins is running things with the purpose of ruining the plant and business, to prevent which she asks for the appointment of a receiver by the court and the sale of the property. Mrs. Williamson is one of the main stockholders and took the lead in the long legal battle which kept the company in the courts for several years past.

Since the business was turned over to him this year by Receiver Guy Mallon, Mrs. Williamson says, Mr. Collins has made himself president of the company at a salary of \$3,000 a year, and at the same time appointed his son, George Collins, vice-president and secretary or treasurer at \$300 a month for his services.

Along with denying the fitness of this appointment, Mrs. Williamson asserts Mr. Collins has complete control, pays no attention to the wishes or advice of the other directors, and never calls directors' meetings. It is alleged that the big cement plant is mismanaged and its opportunities for profit allowed to pass by.

Mrs. Williamson is suing as a stockholder and bondholder, and says her action is for her own protection and that of other stockholders. Mr. Collins and his friends in the company are holders of the majority of the stock.

Potato Shrubbery at Cement Plant

A landscape architect might arch his eyebrows slightly to see graceful potato vines bedecking the grounds surrounding the office building of the Universal Portland Cement Co. at its Duluth plant, but on the other hand, the workmen at that plant would not have come after hours to prune and mulch spirea, barberry or privet. They did come to circumvent potato bugs and to make it easy for squash and cucumbers to cut their grocery bills.

In fact, they "Hooved" about seventeen acres of ground, available around the plant, each employe being given a 50x50-foot plat, which the company plowed and turned over, without any strings attached. Perhaps because so directly under the eye of the superintendent, the potato patch illustrated above showed more sturdy growth and potato bugs thought twice before appearing during working hours.



Workmen Cultivated Potatoes in the Front Yard of the Duluth Office Building of the Universal Portland Cement Co.

Device Saves Much Cement

The Frisco railroad, in matters of economy, pays attention to the little things as well as the big ones.

It established recently what is believed to be a precedent, when it devised an apparatus for cleaning empty cement bags.

The method has proven successful and has effected a great saving in cement as well as in cleaning the bags, enabling them to be easily sorted and repaired.

Heretofore the services of men with large needles were required for repairing these bags. This work is now done by two girls on an ordinary sewing machine in a fraction of the time it formerly required.

The machine, which was built at a cost of only \$65, consists of a large funnel made from old metal car roofing. In this funnel are four screens of different mesh, which causes the cement to fall in a pipe, from which it is sucked. One man only is required to handle this machine.

The empty bag is placed at the mouth of the funnel and compressed air blown through it, forcing the cement out and through the screens.

In August this year, 49,000 sacks were cleaned in

this way, resulting in the reclaiming of 23,000 pounds of cement.

While this is a great saving, the chief economy is in the repairing of the bags and the ease with which the labels can be distinguished.

The machine was made of old material on hand at the reclamation plant and is the idea of C. A. Bodman, superintendent of the plant at Springfield, Mo.

American Concrete Institute

Mr. Harold D. Hynds, who has been secretary of the American Concrete Institute for the past two years, has recently enlisted in the Engineering arm of the service of the United States. In consequence of this step he tendered his resignation as secretary which has been accepted by the Board of Direction.

Mr. Henry B. Alvord, who has been Administrative Assistant for the past nine months, has been appointed

as Secretary. Mr. Alvord is a graduate of the Massachusetts Institute of Technology, Class of 1907, in the course of Civil Engineering. After being connected with the Institute of Technology for three years as Assistant in Civil Engineering, he was called to Bowdoin College as instructor in Civil Engineering and Geology. Later he was made Assistant Professor in Mathematics and Civil Engineering. For the last three years he has been connected with the Aberthaw Construction Company of Boston. He will continue his present duties in connection with those of the Institute.

In the past twelve months the Institute has published Volumes IX, X, XII and XIII, which brings the publications fully up to date. Under the efficient management of President W. K. Hatt and the Board of Direction, the Institute is making a very creditable showing in the work which it is doing in its own field. Over one hundred names have been added to the membership list in the past twelve months, the technical committees are actively at work, and from present indications a very successful Convention is anticipated. This will be held next February 7th, 8th and 9th, at Hotel LaSalle, Chicago.

Sand and Gravel Dealer Has a 1,000-Foot Conveyor in Yard

One of the best equipped yards in the Central West is that of the Interstate Material Co., at Davenport, Ia., whose steel bins and gravel conveyor are notable features of equipment that deserve special comment. Besides dealing in everything in the field of fire-resistive building materials, the Interstate company handles immense quantities of river sand and gravel supplied from its own properties and transferred to its yard by its own barges, and then deposited in huge elevated steel bins by the combination use of a hoisting engine and a long distance belt conveyor.

The first part of its present conveyor system was installed by the Interstate company in 1913, and has been in use continuously ever since, without serious breakdown or depreciation. The remainder of the conveyor system was added early this year.

The whole length of the conveyor itself, in which the sand and gravel are carried from the barge to the bins, is 500 feet, making the conveyor belt a loop of more than 1,000 feet.

Manager Kelley explained that up to this year a locomotive crane had been in use, but as a result of close tab upon the expense, it was found possible to successfully substitute a hoist engine with a stiff leg

within a few months. Equipment for manufacturing the concrete roofing tile was purchased of the Walter Concrete Machinery Company, 418 Saks Bldg., Indianapolis, Ind. Members of the new firm, acting independently, have erected a number of concrete houses in various sections of Connecticut and it is expected that in addition to the manufacturing of concrete shingles the firm may branch out and erect houses of the material.

The new company believes that with the prices of wooden shingles constantly advancing concrete shingles can be manufactured and sold at a figure which will put them in active competition with the wooden ones. An unlimited supply of sand and gravel in the vicinity of Bristol makes the town an ideal place for the location of such an industry and will assist in making the cost reasonable.

The Acme Brick Co., Barton, Wis., has completed a new plant adjoining the brick yards, in which it will also manufacture Walter concrete roofing tile in large quantities. The new division of the business will be known as the Acme Tile Co. The principal product will be a roofing tile, to be manufactured in a variety of colors, from the natural gray cement color to the vivid red of the burnt clay tile. The plant was erected and equipped under the direction of Emil Johannes,



A Unique Battery of Containers Which Makes the Handling of Heavy Staples an Economical Proposition

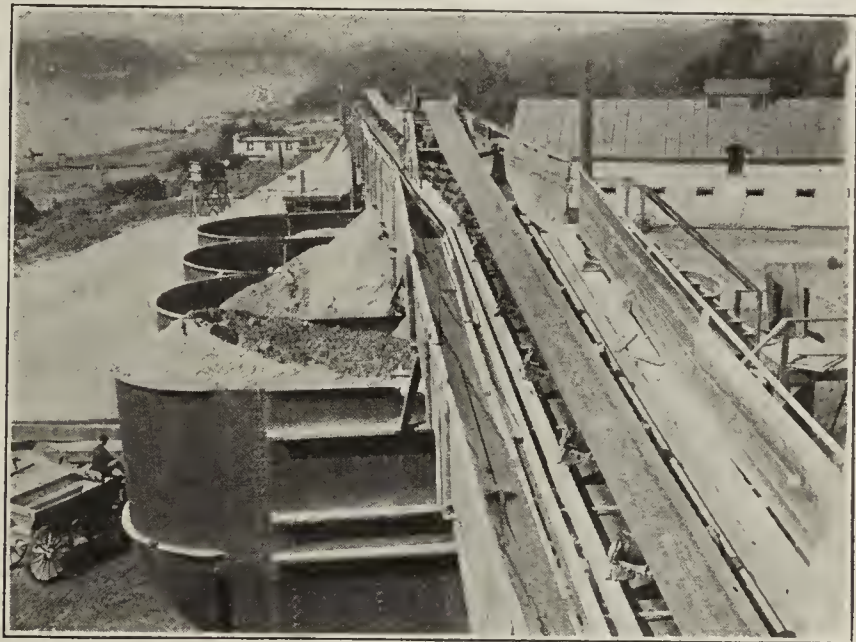
derrick and level system, and by this means to materially reduce the cost of handling.

Since the completion of these new features the company has run four barges of sand and gravel daily with an average transportation and storage record of about 500 cubic yards per 10 hours.

The great steel tanks which hold the Interstate company's deposits of sand and gravel have been hung like a group of gigantic bags from scaffoldings high enough to permit the loading of the company's trucks by gravity from trap doors beneath each one. They afford unusual protection for their contents against weather and moisture conditions, and are the first of their kind in this section of the country.

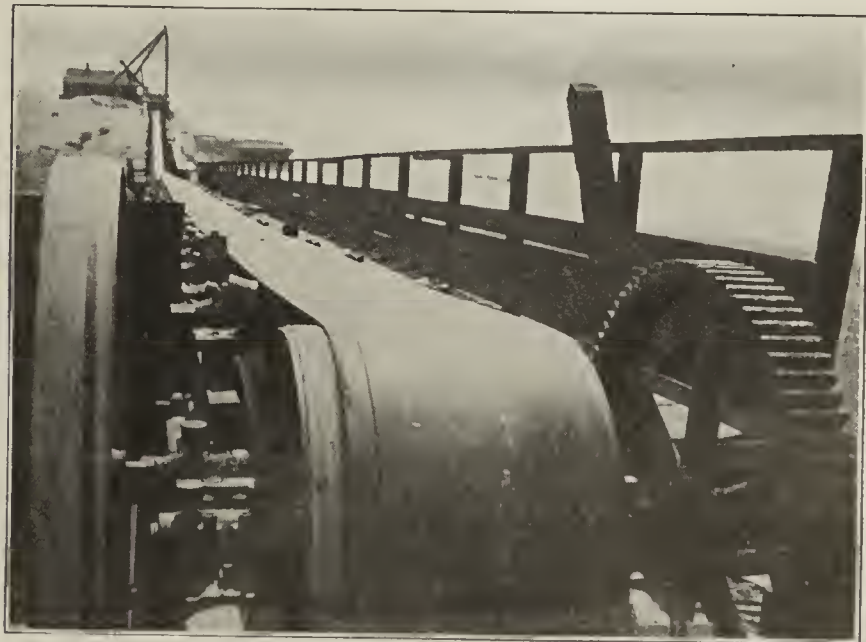
New Concrete Roofing Tile Plants

Bristol, Conn., has a new industry. Montagu Hamm, Samuel S. Meiklem and Charles A. Runge, all prominent residents of Bristol, have incorporated under the firm name of Hamm, Meiklem & Runge, Inc., secured territorial rights for the manufacture of concrete shingles and will, it is expected, be in operation



Looking into the Steel Bins of the Interstate Company from the Tripper's Level

of the Walter Concrete Machinery Company, 418 Saks Bldg., Indianapolis. Charles W. Wendt, who brought the Acme Brick Co. to its present profitable position in the brick world, will have personal charge of the new tile plant as general manager.



Looking "Up the Track" of the Interstate Company's One Thousand Foot Belt

Tunnel Work is Speeded Up by Efficiency of Plant for Handling Material

An 8,300-foot long tunnel has recently been completed at Evanston, Ill., for the purpose of turning the sewage disposal from Lake Michigan into the North Shore branch of the Chicago Drainage Canal.

The work was done by the Nash-Dowdle Co. of Chicago in less than six months' time.

It required 675,000 feet of hardwood lumber for timbering; about 25,000 cubic yards of sand and gravel, and approximately 20,000 barrels of Portland cement to build this tunnel; and the efficient methods used in handling these materials readily accounts for the good time made.

There were about 191 men employed on this work and they could drive and line about 68 feet of tunnel a day or an average of about .35 foot a day per man.

The material encountered in excavating was sand, mixed sand and clay. Heavy timbering and grouting

make land for a park. To facilitate in placing the fill a traveling incline was erected.

The tunnel work on this contract was under the general supervision of Mr. George W. Jackson, acting for Nash-Dowdle Co. Mr. E. A. Clark was assistant engineer.

Gravel and Crushed Stone.

There are some decided advantages in gravel for reinforced concrete work. The rounded pebbles slide readily upon one another and settle into holes and vacant spaces. This tends to make a good, dense concrete and to cover well the steel reinforcement. Broken stone does not have this advantage and it is harder to fill up the voids.

Gravel stones themselves are generally dense and



Handling Sand and Gravel on Construction Work

was necessary to hold the roof of the tunnel and prevent loss of air.

The work was carried on by six headings from three shafts and under four to ten pounds of air pressure. All machinery at the shafts, such as compressors and elevator hoists, was operated by electricity.

The gravel and sand for this contract was delivered at a railroad siding about a mile from the work. This material was unloaded by means of a dragline derrick equipped with a one-cubic-yard Ruddock clam-shell bucket, working on a fifty-foot boom.

By means of this derrick equipment, material was transferred from cars to 25-ton elevated Sunbury material bins. From here the gravel and sand was discharged into motor trucks. Two trucks were used, each having a capacity of $7\frac{1}{2}$ tons, and together they handled about 100 cubic yards a day.

Concrete was mixed at the top of each shaft and dumped into cars of one-half cubic yard capacity, which were lowered down the shaft on the elevator, and then hauled by mules to the desired point.

The waste from the excavation was hauled to the lake front by teams and used to extend the lake shore and

hard and comparatively non-absorbent, hence if the voids between them are filled with a dense mortar, the concrete will be practically waterproof. This is another great advantage in reinforced concrete work.

Gravel stones are furthermore very little affected by the action of heat, and a concrete in which gravel in the aggregate will behave splendidly in a fire. This is still another great advantage.

Gravel concrete does not compare favorably with limestone concrete in the matter of crushing strength in cubes. It is therefore unsafe to use with the excessively high unit stresses so commonly employed, especially in columns.

If the unit stresses employed are not high, say not above 650 pounds in any case, preferably 600 pounds, gravel concrete is excellent for use in reinforced concrete construction, provided the columns are hooped and not of the dangerous rodged variety.

Crushed limestone is a standard and good material for reinforced concrete. Crushed slag has not had the trial nor the disinterested investigation that a material needs to establish its place. Yours truly,

EDWARD GODFREY,
Monongahela Bank Bldg., Pittsburgh, Pa.

Concrete Road Construction In Kansas City

It was the activity of a private inspector employed by the Portland Cement Association that was responsible for building a part of the one-half mile of the Hillcrest concrete road according to specifications. Had the taxpayers been required to rely wholly on the inspection of the county's men objection might never have been raised to the manner in which this road was being built.

Paul A. Hartung, former chief deputy in the highway engineer's office, was awarded the contract to pave this road one year ago.

As this was to be the first concrete road in Jackson County, the local Portland Cement Association decided to place an inspector on the job in the expectation of making it a "show road" for this country.

The private inspector did not begin work until nearly half of the lower end of the road had been finished.

The stone also contained a much larger per cent of fine rock than was specified in the contract.

2. Concrete that contained frozen lumps of material was mixed and used.

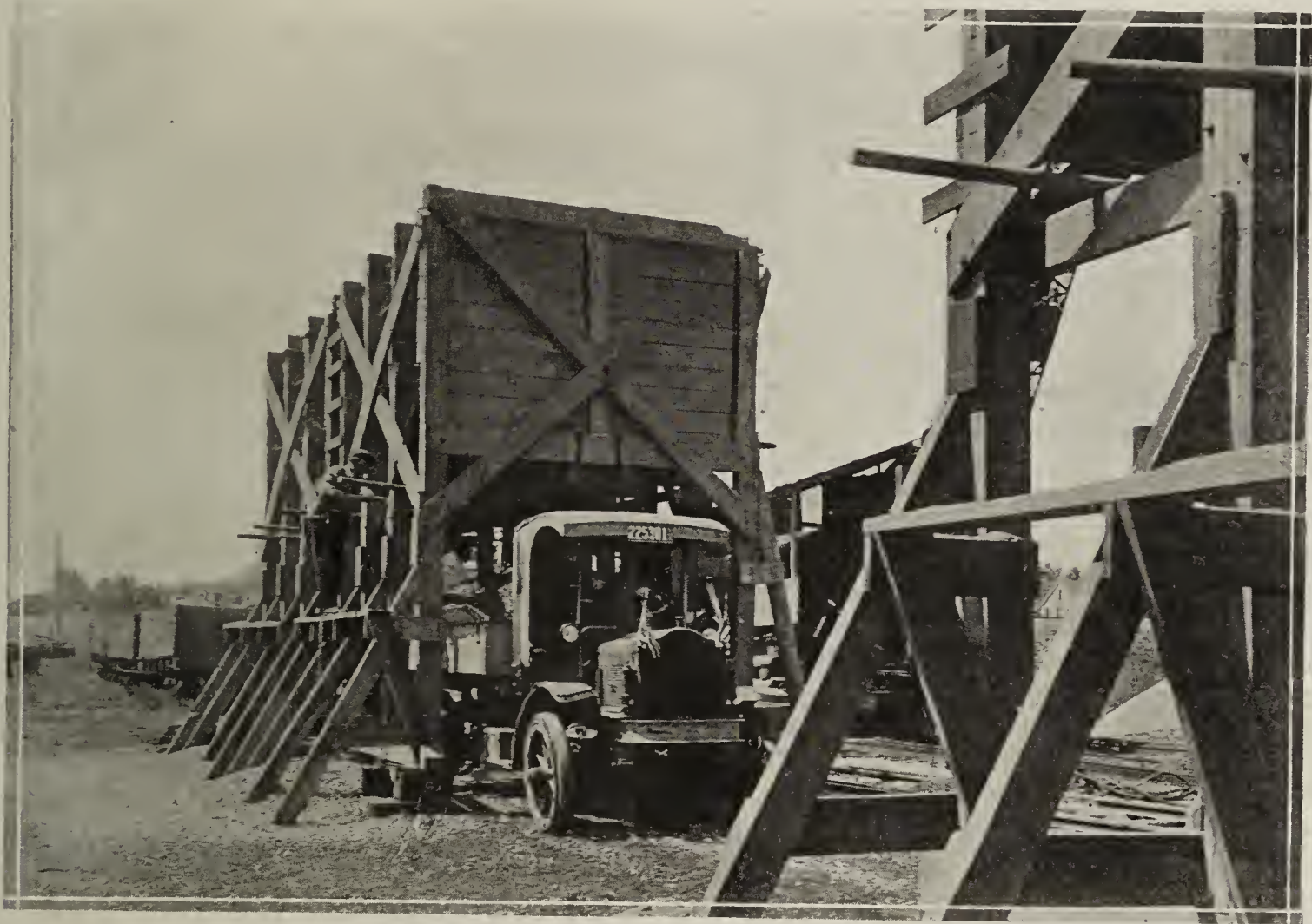
3. Concrete was laid on a frozen sub-grade.

4. The re-enforcing used was of wire 25 per cent lighter in weight than provided by the specifications and was not the equivalent of the wire specified.

5. In finishing he used no bridge from which to finish the surface, and the finishing was not done with a wooden hand float, as required in the specifications, resulting in a rough and uneven surface.

6. He allowed hauling over the concrete when it was one week old and therefore green and had no strength, which has done considerable damage to the road, which cannot be repaired.

7. He took no adequate precautions to protect the



From Material Bins the Gravel Is Discharged into Motor Trucks

This part had been supervised by a county inspector.

November 21 the inspector for the cement association and several of its members appeared before the county court and charged that the road was not being built according to specifications.

Hartung admitted that in minor details he had not followed the specifications. He blamed this to the fact that one page of the contract had been lost. The court ordered Hartung to stop work until spring and ordered an investigation by the highway engineer. Meanwhile the cement men's association never took its eyes off the Hillcrest Road.

Bore Out the Charge

December 1, A. W. Mosely, chief deputy highway engineer, filed a report with the county court containing the charges previously made by the cement association. They were as follows:

1. A substantial percentage of the stone used would not pass a 2-inch aperture as specified in the contract, and contained many large flat rocks which made a well worked and finished surface impossible. A portion of the old macadam removed from the former road was used with the stone, this being done after its use had been forbidden by the chief deputy highway engineer.

work from cold weather, and as a result a part of it has been frosted.

8. A large portion of the work was done and finished without expansion joints, as required by the specifications.

9. A letter written to him by the chief deputy highway engineer, calling his attention to the above delinquencies, was not heeded, and with the exception of providing expansion joints, no improvement in the work was made.

The cement association's inspector remained on the job until the road was completed. One month ago Hartung was paid the balance due on his contract. In all he received \$20,934.25.

Hartung was one of the most experienced engineers ever employed by the county as chief deputy in the highway engineer's office. His defense to the cement association's charges was that the conditions complained of arose largely from circumstances over which he had no control.

The fact remains, nevertheless, that work on the road was stopped as a result of the charges made by the cement association's inspector. The south one-half of the road was finally built under rigid private inspection.—[Kansas City Star.]

Stone Production in 1916

The value of the stone produced in the United States in 1916 was \$79,041,699, as reported to G. F. Loughlin, of the United States Geological Survey, Department of the Interior, an increase of nearly 6 per cent over the value for 1915.

Of the total value over 52 per cent, or \$41,319,871, was represented by limestone, an increase of more than 17 per cent over the value for 1915. Marble, valued at \$7,033,171, representing nearly 9 per cent of the total, was the only other kind of stone that showed an increase (about 2 per cent).

Of the other kinds, granite was valued at \$17,418,582, basalt and related rocks at \$7,666,297, and sandstone at \$5,603,778, representing respectively 22 per cent, 10 per cent, and 7 per cent of the production, and decreases of about 3 per cent, 10 per cent, and 8 per cent of the value as compared with 1915.

The leading states and the value of their output, which represented over 63 per cent of the total, were as follows:

Pennsylvania	\$11,021,655
Ohio	6,611,266
Vermont	5,691,420
New York	5,342,954
Indiana	4,657,813
Illinois	3,403,094
Massachusetts	3,138,165
California	3,133,305
Wisconsin	2,757,790
Michigan	2,494,284
Missouri	2,242,742

In 1915 the rank of these states was (1) Pennsylvania, (2) Ohio, (3) New York, (4) Vermont, (5) Indiana, (6) California, (7) Massachusetts, (8) Illinois, (9) Virginia, (10) Wisconsin, (11) Missouri. New York, Massachusetts and California showed decrease in value in 1916. New York was passed by Vermont; California and Illinois exchanged places; Virginia, with a greatly decreased output of stone for road building, dropped out of the leading states in 1916, and Michigan entered, ranking next to Wisconsin.

Of the 48 producing states 32 increased in value of output and 18 decreased.

The number of active quarries decreased 252—from 3,278 to 3,026. This decrease was due to the closing of small quarries that supplied stone to local trade and to the adverse conditions affecting labor and supplies.

According to uses, the value of stone produced was distributed as follows:

Building (rough and dressed)	\$15,001,390
Monumental (rough and dressed)	7,036,536
Paving	2,687,605
Curbing	1,611,001
Flagging	409,665
Rubble	825,330
Riprap	3,635,167
Crushed	29,462,952
Flux (limestone)	13,936,882
Ganister (sandstone)	529,805
Other uses	3,905,366

\$79,041,699

All the above decreased in value in 1916 except crushed stone, flux, and ganister, which increased, respectively, 1 per cent, 44 per cent, and 58 per cent. The value of stone classed under "Other uses" also increased in 1916. The greater part of this value is represented by limestone, the demand for which, on account of its chemical properties, increased greatly.

Cement Company Wins In Court

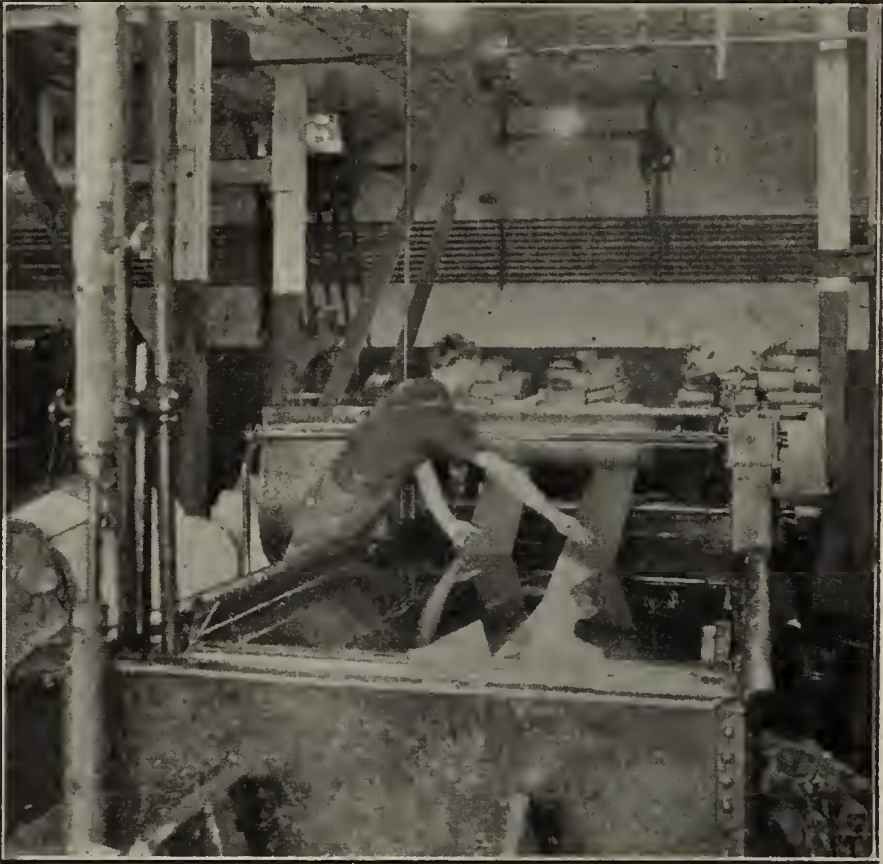
A decision was handed down recently by the State Industrial Commission in the case of Robert A. Rich, an employe of the Hawkeye Portland Cement Company of Des Moines, who brought action for compensation for an injury suffered by him on April 27, 1917, resulting from an explosion of dynamite caps which occurred when he struck a match to light a cigaret.

Commissioner A. B. Funk ruled that in lighting a match for the purpose of smoking a cigaret, the employe was merely satisfying a personal indulgence. For this reason no compensation was allowed.

Cement Plant Superintendent Joins the Army

Mr. John J. Quint has resigned his position as superintendent of the Golden State Portland Cement Co. at Oro Grande, California, to join the Army.

Mr. Quint has been associated with this company nearly five years.



Waterproofing Sawyer Belts

The waterproofing of Sawyer Stitched Canvas Belts is a very important step in the manufacture of this belting. Extreme care must be exercised in the choice of the oils to be used in this operation.

The accompanying photograph gives some idea of how thoroughly this part of the work is done. Immersing the belts thoroughly in this compound makes them impervious to the action of water, steam, oils and gases, and through this compound they retain their natural elasticity and flexibility during the entire life of the belts.

Treating the belts in this manner is the third step in the manufacture of these belts which are made to give satisfaction, and where all is said and done, the final test of a belt can be summed up in these words: Will it give service?

New Book; "Everyman's Chemistry"

Harper & Brothers have just issued a new book entitled "Everyman's Chemistry," by Ellwood Hendrick. This book is unusual in that, while designed for the layman, it considers the subject in the order and method usual with chemists and yet is easy and pleasant reading.

The reader is first introduced into General Chemistry with such a wealth of anecdote and good-natured comment that it is well worthy of perusal if only as a pastime. In a little while, nevertheless, the reader finds himself thinking as chemists think, which is the primary purpose of the work. From this he is led into Inorganic Chemistry with observations on the nature and ways of the different elements and their compounds; then follows Organic Chemistry which include a short consideration of coal tar products.

To those who wish they knew something about chemistry this book opens the door. It does not profess to be a complete treatise and is in no sense a laboratory guide. On the other hand, it does contain so much chemical information, arranged in proper order, and it is entertaining withal that even the casual reader is bound to gather from it a sense of chemistry.

The author is well-known in New York as one who brings an attractive literary style to the discussion of chemical subjects. His daily articles in The New York Times during the week of the chemical exposition in September have aroused general interest in the progress and application of the science among many of those who heretofore declared it to be a closed book to them. Price \$2.00 net. Sent on receipt of price by Cement & Engineering News, Transportation Bldg., Chicago.

New Catalog on Power Tamper for Concrete Product Plants

Catalog No. 28 is the latest advertising effort of the Ideal Concrete Machinery Company, 1353 Monmouth Ave., Cincinnati, Ohio. It is a very handsome book, 9 by 12 inches in size, and fully describes and illustrates the Ideal Automatic Power Tamper and the Ideal Scraper and Finisher Attachment.

This book shows a number of working illustrations of this equipment used in conjunction with the Ideal Block Machine and it is full of interesting facts concerning the practical and economical manufacture of concrete building blocks.

Many reasons are given to show that machine tamped blocks are best and it does also show that by the use of this equipment the manufacturing cost of hollow concrete blocks is reduced at least one-half and a much better, stronger, waterproof and more saleable block is produced.

The block maker who wishes to improve the quality of his output and increase his profits, will do well to secure and read this interesting catalog.

Asks Joint Cement Rate

Pacific Portland Cement Company, which operates a large plant at Cement, about ten miles east of San Francisco, applied to Commissioner Loveland yesterday for the establishment of a joint rate by the Tidewater Southern Railway, the Southern Pacific Company and the Cement, Tolinas and Tidewater Railroad, so that the cement company might compete at Stockton and elsewhere with the Cowell Lime and Cement Company.

This latter company, it appears, has secured already a joint rate through to Stockton.

The rate asked by the Pacific Portland Cement Company is \$1.15 from Tolinas to Stockton, and James A. Keller, traffic manager, introduced testimony yesterday that since March 5, 1917, his company had shipped 5,560,000 pounds of cement over the Tidewater and Southern Railway.

The present rate paid by the Pacific Cement Company to Stockton amounts to about \$1.90.

Judge Finds Cement Company Not Guilty

Three years' litigation, based upon charges that the Cowell Lime and Cement Company of Cowell, California, had committed a public nuisance by allowing the dust from its plant to settle upon the neighboring crops, ended on October 15th, when Superior Judge R. H. Latimer found the company not guilty. Horticultural experts and numerous cement officials were subpoenaed during the course of the trial, which began January 5, 1914.

Unusual Effects in Stucco

The builder of the house illustrated on this page writes a very interesting letter regarding his work and how he produces a distinctive surface finish which is free from air cracks:

"I produce a surface finish of unusual texture and to me extremely attractive. I use the term 'Undulating Brush Coat Finish,' although this does not accurately describe the texture. This finish gives the appearance of an unusual thickness of wall and the dust that naturally settles on the external walls of the finish really adds to the artistic effect for it accentuates the unevenness of the surface.



Front Elevation of Stucco Houses, Scranton, Pa., Erected by Geo. B. Dimmick

I use three-coat work altogether—the last two coats being put on in rapid succession. The last coat is thrown on in large irregular lumps, roughly troweled down and then *blended* into the surrounding surfaces by using a broad whitewash brush. A surface having a final finish put on in this manner does *not* develop the number of cracks or hair lines that a float finish does. *I think many cracks in stucco are caused by the lateral pressure exerted by the plasterer with his float.*

(Signed) GEO. B. DIMMICK,
Scranton, Pa.

C. T. Davis

C. T. Davis, former superintendent for the Altoona Portland Cement Company, Altoona, Kans., is now in charge of the cement mill, mining and crushing machinery department of the Walter A. Zelnicker Supply Company of St. Louis.

New Cement Plant for Brazil

Various newspapers published in the state of Minas Geraes, Brazil, as well as certain commercial reviews of the city of Rio de Janeiro, says the American consul at Rio de Janeiro, have commented on the possibility of developing the manufacture of cement in this country. It is stated that a plant is under construction at Bello-Horizonte, the capital city of the state of Minas Geraes, which is expected to produce considerable quantities of this product. It is to be operated under the firm name of Macchiorlatti & Co.

This firm claims to have invented a wood-burning oven specially designed for the purpose, capable of attaining, without consuming large amounts of fuel, 2,000 calories of heat. It is also claimed that the clay and other substances necessary to the production of cement, which are said to be found in abundance near the properties of the company, are free from traces of iron and particularly well adapted for use in the specially designed ovens of the company. Several experiments have been made at the plant, and such are reputed to have produced very satisfactory results, and production upon a large scale expected shortly.

Cement Company Declares Extra Dividend

Additional testimony of the full-pulsed prosperity of the cement industry was furnished on October 15th, in the shape of the declaration of an extra dividend of \$1.50 a share on the stock of the Pacific Portland Cement Company Consolidated of San Francisco. This special disbursement will be paid to the stockholders on October 25th, together with the regular monthly dividend of 25 cents a share on the 60,000 shares outstanding and of record September 29. The Pacific Company retired the last of its bonds on August 2, 1916, and has been rolling up earnings ever since.

Special Cement Rates

An order was issued recently by the railroad commission of Texas approving the application of the International & Great Northern Railway Company making cement in carloads minimum carload weight 60,000, between Cementville and points named subject to the following charges:

To San Antonio (points on International & Great Northern tracks within city limits), 1½ cents per 100 pounds; to San Antonio (points on International & Great Northern tracks at Camp Kelly or South San Antonio), 1½ cents per 100 pounds plus \$5 per car.

It is stipulated that these rates are not to be used as basing rates or as a division or basis for division on shipments to stations beyond.

Dewey Cement Plant Busy

They are not turning out war munitions at the Dewey Portland cement plant, Dewey, Okla., but there is not a plant in the United States that is busier than this one. The other day one of the head officials of the plant made the statement that the company was away behind in its orders; that it would take the company weeks to fill the present number of orders on hand, and that more men were being employed at the cement plant at present than ever before. Nearly 300 men are employed in this plant. Quite a number of skilled and unskilled men were drawn in the war draft.

It is not unlikely that steps will be taken within the next year to increase the size of the Dewey. Its present capacity is 2,500 barrels a day.

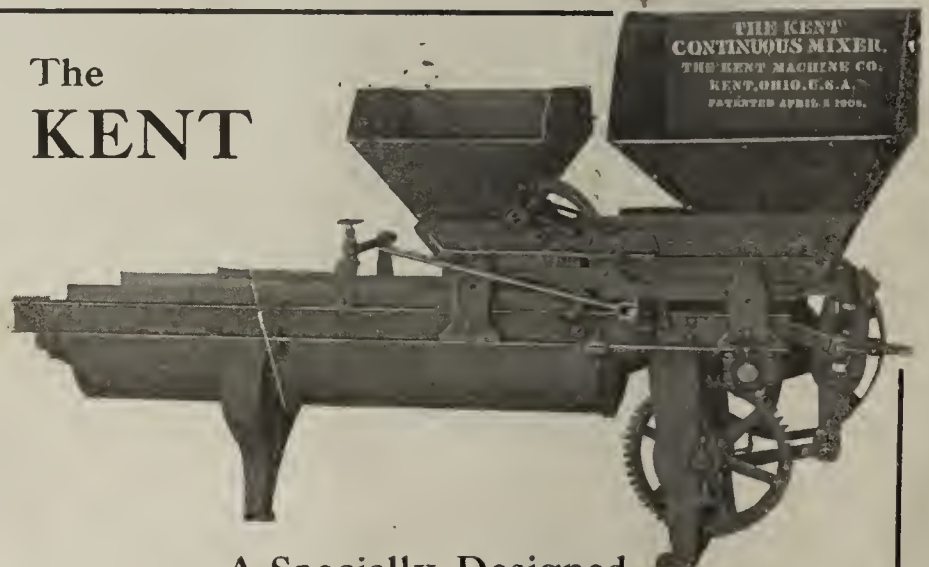
Potash from Cement Dust

That between 71,000 and 75,000 tons of available recoverable potash—about one-third of the quantity normally consumed in the United States—exists in the dust passing through or retained in the flues of the cement manufacturing plants of the country is indicated by analyses made by the Bureau of Soils of the United States Department of Agriculture, according to a recent publication, Department Bulletin 572. By increasing the percentage of potash volatilized, by the addition of substances which will not affect the quality of the cement, the recoverable potash in flue dust can be increased to more than 100,000 tons annually, or nearly one-half of the normal consumption of potash in the United States, according to the bulletin.

Numerous cement plants have installed electrical precipitation equipment to recover the flue dust, and are finding the installations good investments, the bulletin declares. Some plants are recovering 95 per cent of the potash present in the raw materials fed into the furnaces.

The dust recovered in the flue stacks, connecting kilns, and precipitation apparatus is about 4.5 per cent potash, while that recovered from the precipitation apparatus itself is about 11 per cent potash. The dust may be used as a source of cement material, may be disposed of as collected for use as a fertilizer or in fertilizer manufacturing, or may be leached to prepare concentrated potash salts.

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A Specially Designed Mixer for Products Plants

Seventy per cent of the bigger block, tile, brick and specialty concrete products plants of the country use the famous Kent Mixer.

Equipped with automatic feeding device, it makes certain a proper proportioning of aggregates and being continuous in operation, it saves time and labor. The biggest concrete products plant in the world has found that four Kent machines will mix fast enough to keep its many tampers and mold machines busy.

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